The Dock and Harbour Authority

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Editorial Comments

The Port of Dakar.

Dakar, the largest port of French West Africa and also the capital and administrative centre, is situated on the south-east side of the Cape Verde Peninsula behind the Island of Goree. It owes its importance, firstly, to the Daker-St. Louis Railway, opened in 1885, which connected Dakar with the Senegal Valley, and secondly, to its strategic position as a port of call and bunkering station for shipping engaged in the South American and South African trade. In more recent years, it has become an important air terminal for transatlantic flight and the base of many air lines.

Such factors as these have helped Dakar to become the first port of the French Colonial Empire and the third port of the French Union, being surpassed only by Marseilles and Le Havre in respect of the volume of tonnage handled. Visitors are particularly impressed by the beauty and cleanliness of the well planned city and the size and scale upon which the port is built.

We are indebted to Monsieur P. Bourrieres, Director of the port, who has kindly supplied the details from which the leading article for this month has been compiled. It will be seen that during the last few decades striking progress has been made in providing adequate port facilities and that a modernisation scheme involving further extensions is now in hand, also that still further plans for future developments have been prepared.

As far as the present layout of the port is concerned, one aspect which is very noticeable is the policy of zoning or providing special areas for specific purposes, i.e., one area is used exclusively for fuel, one for groundnuts (the most important export), one for phosphates and general cargoes, and another for passengers, while storage tanks are set apart in yet another locality for groundnut oil, which is pumped into tankers through pipe lines. More than half the berths have a minimum of 10 metres of water alongside, and vessels drawing up to 35-ft. can enter or leave the port at half tide.

From the many cross-sections in the article, it will be seen that the construction of the moles has followed the concrete block principle which is the method so frequently used by engineers when building colonial seaports of the character of Dakar. The design of the transit sheds and the ample widths of quays and storage space provided will also be noted as well as the layout of the railways and sidings. Incidentally, when the photograph of Mole 2 was taken, the railway tracks had not been laid.

The provision of fuel oil and coal for bunkering vessels is, of course, of great importance for a transit port such as Dakar, and the facilities furnished are worthy of examination.

In view of the encouraging survey given by our contributor, there is every justification for the Director of Public Works to express his confidence that the economic expansion of the Federation of French West Africa warrants the programme of improvements proposed, and there seems little doubt that the Port of Dakar will continue to hold a leading position as both a transit and commercial port.

Port Accommodation Problems for Large Tankers.

An interesting point which has been raised in the South African press concerns the accommodation necessary for oil tankers of over 20,000 n.r. tons which call at the Union's ports. It appears that originally, the so-called "super" tankers were designed to operate between oil producing countries and refineries in Europe and the United States, where oil receiving terminals of sufficient size are available to accommodate them. Recently, however, two oil tankers each drawing over 30-ft. arrived at Cape Town, and owing to their size, were not able to tie up at the normal oil berth, and therefore had to be discharged at a nearby cargo wharf, with the result that a passenger liner was compelled to anchor in the Bay until the berth was vacated.

It will be remembered that in last month's issue we reported that a similar problem was discussed a few weeks ago at a meeting of the Belfast Harbour Board, when considering the additional depth of water required for accommodating the larger tankers now coming into service at that port.

We now learn that the second of two 31,000 ton deadweight tankers, constructed at the Barrow-in-Furness shipyard of Messrs. Vickers-Armstrongs Ltd. was launched this week on behalf of the North American Shipping and Trading Co. (London) Ltd. This is a sister ship to one which was launched at Barrow, for the same Company, on October 16 last. Incidentally, as she bears the yard number 1,000, it was a somewhat momentous occasion in the history of the shipyard.

Incidents such as these raise a number of questions concerning the commercially economic size of tankers for general trade, because continual increase in their size confronts many ports with the problem of providing larger and more adequate oil wharf facilities which are now essential in any modern harbour. In our view, one aspect of this problem is whether the time may not soon arrive when consideration should be given to the desirability of arriving, internationally, at some sort of understanding or agreement between oil companies, ship owners and dock authorities in respect of maximum tanker sizes.

Editorial Comments—continued

It is evident that what may be considered economic on the one hand, may be quite the reverse on the other (and this applies not only to oil tankers) having regard to the physical and economic limitations in depth of water, widths of channels and entrances, etc., in many docks and harbours of the world.

Turn-round Delays to Ships in Port.

The serious effects of the slow turn-round of ships in port, with consequent congestion, continues to cause grave concern throughout the world. The subject was discussed last November by the International Chamber of Commerce, when it was decided that their Committee on Sea Transport, working in close co-operation with the International Chamber of Shipping, should study the causes of delay and the resulting additional costs on commodity prices. The latter body, at its meeting last month, issued a memorandum calling attention to the seriousness of the position and pointing out that the solution of the problem is to be found through local and national action.

There are many factors causing delays to ships in port, such as restrictive practices, working to rule and "go slow" methods, besides a recalcitrant attitude of labour towards mechanisation which, unfortunately, are prevalent in many countries besides the United Kingdom. Complaints are frequently heard from Australia, New Zealand, East Africa and South America that cargoes are piling up on the quays or in the transit sheds, while the time taken to unload the ships runs into weeks instead of days. Our readers will find, on a following page, a cogent list of the causes of delay in the lucid statement issued by the International Chamber of Shipping to which we have already referred.

A number of aspects have to be reconciled in dealing with the problem of giving full employment to the dock worker, and at the same time achieving an expeditious turn round of shipping. It is often argued that an answer would be found by using more mechanical handling aids. We agree that used judiciously, efficient labour-saving devices are undoubtedly a great help in this direction; at the same time, however, they are not necessarily the cure-all that is sometimes claimed. For example, quays and transit sheds may be of an old-fashioned design, so that fork-lift trucks and other mechanical handling devices would not make an appreciable difference to the speed of handling, as they could not be manœuvred over uneven floors, or round pillars and other obstacles in their way. It should also be borne in mind that even if the handling of goods in transit sheds is speeded up by the use of fork-lift trucks and palletisation, nevertheless, it is possible that little time will be saved in unloading cargoes from lorries or railway wagons, as the goods do not usually arrive on pallets or in containers, so that they have to be handled by the usual old-fashioned methods. Again, when the goods have cleared the transit shed and been taken to the quayside by means of fork-lift trucks, the rate of loading is still governed by the speed with which the cargo can be stowed in the holds of the ship. Similar arguments can be applied to the unloading of ships.

Comparisons in the speed of cargo handling at ports are frequently made between British and Continental, or British and American ports, but in our view such comparisons are invidious, as several factors, peculiar to each country, have to be borne in mind. Firstly, it is sometimes suggested that a two-shift system, such as that at Rotterdam and Antwerp, should be tried in the United Kingdom; this would involve an appreciable increase in the number of dockers on the register, and especially of key-men, who would be employed on each shift, and owing to the prevailing shortage of man-power, which is badly needed in other industries, an increased dock labour force would not be justified. Secondly, unlike the U.K., Rotterdam and Antwerp have not a dockers' de-casualisation scheme, so that they carry a larger percentage of workers on their registers, without the guarantee that a minimum weekly wage will be paid to each. No one in this country, either the Employers, the Unions, or the Dock Labour Board, want to see such a retrograde step as the return to surplus labour at the docks.

As far as labour problems in the U.S.A. are concerned, the manager of a leading American port, during a recent visit to this country, said that the U.K. Dockers' De-casualisation Scheme was superior to anything tried in America, and in his opinion, this country's psychological approach to the matter was far in advance of the U.S.A.

The recent report of the Working Party on Freight Handling implied that the U.K. had little to learn from the United States, as far as cargo handling methods were concerned. It is true that mechanical handling devices are used to a greater extent in America than in the U.K., but the layout of the ports and the methods of cargo handling are so different that comparison is difficult. For example, the Burtoning System cannot be used very effectively at many ports in this country, as there are more varied ranges of tide at U.K. ports than in America.

In view of the importance of the problem, and the many endeavours which are being made to find a solution, we hope to discuss the matter more fully, from a human standpoint, in an article which will appear in our next issue.

Tidal Model of the River Thames.

Early in 1949, following the preliminary investigations and proposals of a Departmental Siltation Committee, the Port of London Authority announced its decision to construct a scale model of the tidal portion of the River Thames from Teddington to the sea. The matter was referred to in the August, 1949, issue of this Journal, when we reviewed the circumstances which had given rise to the desirability for the unsatisfactory condition of the Thames to be more closely studied than had been considered necessary in the past.

After accumulating the necessary data in respect of siltation and pollution, which, it will be remembered, were the chief items calling for investigation, the construction of the tidal model has now been completed, under the direction of Sir Claude Inglis, Director of Hydraulics Research in the Department of Scientific and Industrial Research.

At the invitation of the Port Authority, the model was inspected last month by harbour engineers, scientists and members of the technical press. Actually two models have been constructed, a pilot model, which we briefly described in November, 1950, and a main model 400-ft. long—at twice the scale of the former—and both are now in process of being proved. Meanwhile, a separate investigation into the pollution of the River is being made by the Water Pollution Research Laboratory of the D.S.I.R. which will, in due course, be linked with the model experiments, to determine the periods of retention in the river of effluents discharged at different places during various states of the tide.

There are technical aspects of these models, such as their construction scales, the bed materials used, and the design of the tide generator, etc., which are of considerable interest; we therefore hope to publish in the near future an article describing the details of the model, the methods of analysis and the scope of the full scale data of the river, together with some indication of the kind of investigations which it is proposed to undertake.

The Suez Canal and Supply Facilities.

The recent repudiation by Egypt of the 1936 Treaty has created many problems concerning the future of the Suez Canal which is of such great importance to world trade. At the same time other ports on the shore sea route to the East, appear to be benefiting from the action of the Egyptian Authorities in withdrawing the usual port facilities in the Canal area. According to reports in the daily press, ships are now taking on supplies of fuel, water and fresh food at such ports as Algiers, Oran, Bona, Genoa and Naples, and are then proceeding straight through the Canal to Port Sudan, Massawa, Aden and ports even further afield. It is also reported that British cargo ships from the Far East which formerly used Port Said, now use Cyprus for transhipping cargoes for west of Suez.

Unfortunately, it appears that the loss to business houses, particularly British, engaged in Suez Canal shipping is already considerable, and it is feared that the present unfortunate situation may continue indefinitely. One can only hope that a solution, satisfactory to all parties, will quickly be found.

The Port of Dakar

A Modern Harbour of French West Africa

By P. BOURRIERES (Director of the Port)*

An Account of Senegal in Former Times

A FEW decades ago, Dakar was merely a small fishing village with a sandy beach, and in less than a century such progress has been made that the population has increased to 140,000 inhabitants, and a modern port with five kilometres of quays has grown from nothing, to become one of the most modern ports in the world, for handling all types of shipping. It was in 1857 that Captain Protet disembarked from the French ship *Jeanne d'Arc* on the day of Ramadan when the whole population was celebrating the feast. Although at that time Dakar had no maritime traffic with Europe, the Bay of Dakar and the island of Gorée were not unknown. Thanks to the presence of the Cap Vert peninsula, which forms the extreme western point of Africa, the Bay of Gorée was used for a long time by navigators; there are traces of the anchorage used by sailors from Dieppe in 1364, and the first occupation of Gorée by the Dutch dates from the year 1588. The insular character of Gorée, and the facilities available for its defence, made it the centre of commercial activity for Senegal, and the objective in conflicts between different maritime powers.

In 1677 the Senegal Company was established, after having concluded commercial agreements and alliances with the local rulers. It was not until 1816 that the Governor of Gorée received instructions to set foot on the peninsula, but it was not until 1857 that a settlement was established on the mainland. A convention was signed between the French Government and the Messageries Maritimes concern, then known as the Messageries Impériales, for the development of a regular shipping line between France and Brazil with Dakar as an intermediate port of call.

This established Dakar as a coaling station of rising importance and in order to replace the coal wharf which had been built in 1848, the Company had to construct a landing stage in Dakar Bay, but this equipment also was soon found to be inadequate; a jetty was therefore built to provide a depth of five metres for vessels mooring alongside, and this work was completed in 1863. These works only provided shelter for the vessels which were moored in the open roadstead, the unloading and loading of coal being done by barges. To improve the working conditions of ships calling at Dakar, a long jetty was therefore constructed at the eastern end of Dakar Point. The Cap Vert lighthouse was put into operation on April 1st, 1864, on the highest local hill, known as Mamelles, and two other lighthouses were built in 1866, one on the Almadies reef and the other at Cape Manuel. Dakar was then equipped for limited passing traffic, and as the hinterland had not yet developed any resources, nothing important happened to the port for a period of 30 years.

Until 1885, St. Louis, which lies to the north of Dakar, was the colony's main port, but the situation was altered when West Africa's first railway was built linking Dakar with St. Louis. The town of Dakar grew up around the port, and in 1898 a jetty, 2,080 metres in length, was built to provide shelter over an area of 125 hectares. Since that time, many port improvements have been carried out, and exports and general traffic has so increased, that as soon as one work was completed it was necessary to begin another. The traffic in various goods for 1950 exceeded the figure for 1949, which had itself beaten all previous records, and it therefore became necessary to build a new mole to deal with the increased volume of trade.

The Modern Atlantic Port of Call

To-day the port of Dakar represents a very fine investment. It enjoys a favourable situation on the routes which link the North and South Atlantic, and is a port of call on the South African-European service and on the route from South America via New York to the Cape of Good Hope. Being at the intersection of shipping routes, half-way between the ports of the American hemisphere and their corresponding ports in the western hemisphere, Dakar is 3,400 miles from New York and 3,600 miles from the Cape of Good Hope, 2,500 miles from London and 2,800 miles frrom Rio de Janeiro, 1,500 miles from Lisbon and 1,800 miles from Pernambuco. Dakar therefore occupies the best position for the refuelling of vessels which stop at this port on their voyages.

Facilities Offered to Ships.

The advantageous geographical situation of Dakar is also enhanced by further very beneficial circumstances; the natural roadstead of Dakar provides excellent shelter without any artificial works, by reason of the particular shape of the rocky peninsula of Cap Vert which provides effective protection against ocean swell; entry to the port is remarkably easy and most vessels using Dakar do not employ tugs.

All ships drawing up to ten metres can enter the port at any state of the tide and pilotage is available both night and day. Dredging has been carried out to provide a depth of 10.70 metres alongside Mole No. 8 to accommodate the liner *Ile de France*. The area of water within the jetties is 225 hectares, of which 52 hectares are dredged to a depth of 10 metres below datum, and 110 hectares to a depth of between 7.50 and 9.00 metres below datum. In order to understand the dredging work, it should be explained that the level of high water at Dakar is about 1.80 metres above datum.

The quays occupy a total length of five kilometres, and there is a depth of 10 metres of water alongside for a length of 2.74 kilometres; the depth for a further 1.63 kilometres ranges from 8.50 to 9 metres; 350 metres of quay have a depth of 7.50 metres and the remaining 200 metres a depth of 6.50 metres. The following is an analysis of the number of berths and the respective depths at each particular basin and quay:—

Petroleum Basin. One berth of 10.70 metres and five of 10.00 metres.

Coal Quay. Five berths of 10.00 metres and three of 10.00 metres.

Groundnut Basin. Two berths of 9.00 metres and two of 7.5 metres.

Southern Zone (various cargoes). Six berths of 10.00 metres, four of 8.50 metres, six of 8.00 metres and one of 6.50 metres.

Water Supply.

There are 105 supply points for water in the port, permitting a vessel to receive water from at least two outlets at once, the rate of discharge being from 60 to 150 cubic metres per hour. If the ship is moored suitably, she can at the same time receive water from the outboard side from fresh water tank barges owned by the port, the discharge from which is at the rate of 100 cubic metres per hour. Such water is cheap, of high quality and regularly purified. Analyses are frequently made both of the water in the reservoir and where it is discharged into the ships. Any traces of pollution are removed by disinfection.

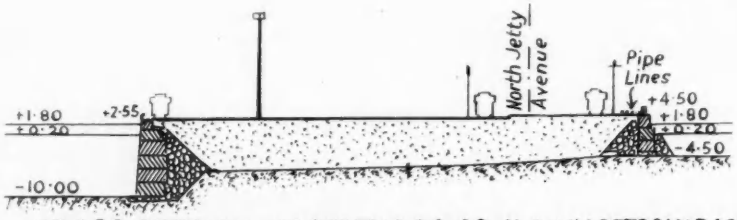
Supply of Fuel.

There are four suppliers of liquid fuel and one supplier of bunker coal, all being fully equipped for high speed handling of these materials. It is possible to coal five ships at once at a rate of 800 tons an hour, either at the quayside, or in the open roadstead, by means of floating coaling plants.

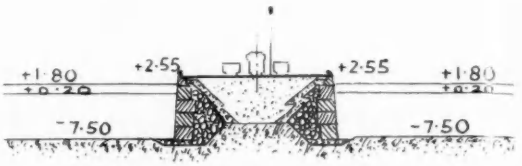
Supply of liquid fuel is also available at the quayside, by land pipelines to the tanker moorings and to the petroleum quay, and by tank barges to all other quays and to the open roadstead. The total capacity of liquid fuel handling equipment is 2,500 tons an hour, and it is customary to load one vessel at the rate of 1,000

(*Translated from the French by Rolt Hammond, A.C.G.I., A.M.I.C.E.)

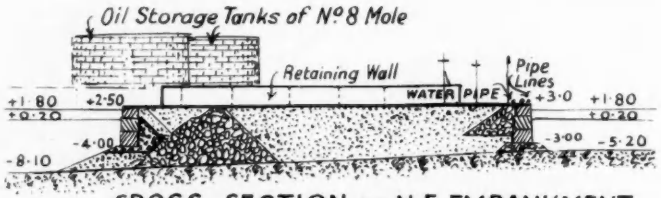
The Port of Dakar—continued



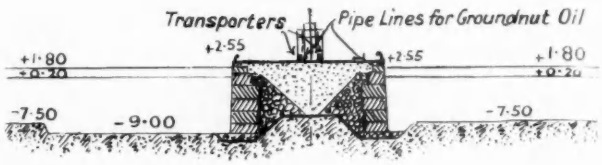
CROSS SECTION AT BERTHS 39,40-N.QUAY-PETROLM BASIN



CROSS SECTION OF MOLE 5.



CROSS SECTION OF N.E. EMBANKMENT



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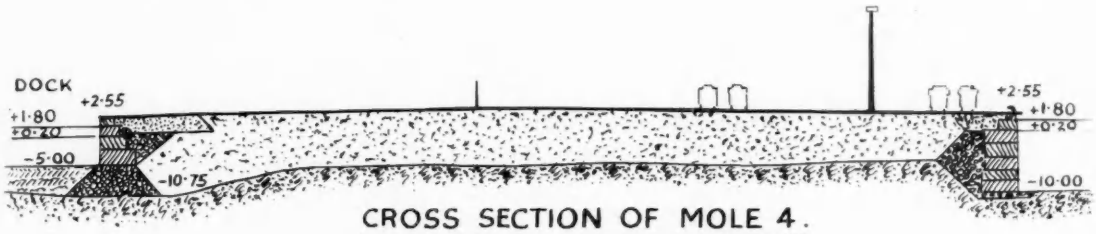

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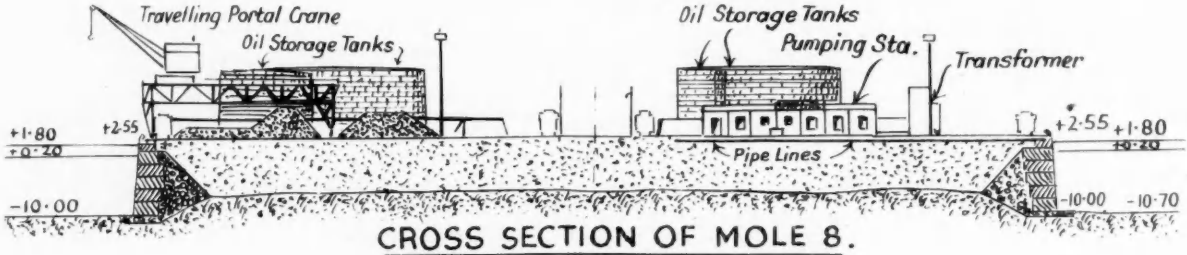


CROSS SECTION OF MOLE 8.

tons an hour if she is able to receive it at that rate. It is possible to refuel five ships alongside the quay and four ships in the open roadstead at once, the rate of supply for each being 250 tons an hour.

Protective Works

The water area of the port is 281 hectares and 56 hectares of land have been reclaimed from the sea. The port is open to the east, and is protected against the Atlantic swell by the peninsula of Cap Vert, the north jetty having a length of 2,080 metres and the south jetty of 500 metres. Since these jetties do not suffer from heavy swell, they have been very lightly built of basalt masonry blocks of rough walling with cement mortar, and they require practically no upkeep. The foundations also require no repair, because there is no silting.

Traffic Zoning

Allocation of different traffic zones is very carefully carried out and if at times there is congestion, it is due only to a momentary crowding of certain types of vessel, but the situation soon returns to normal. On the right-hand side of the entrance to the port, in that district which is not so well served with land communication, but with immediate access to the sea, is the petroleum basin, which is somewhat isolated from the town. This has a water area of 20 hectares and six berths alongside the quays ; there is a complete system of pipelines for crude oil and refined spirit. These pipelines serve equally well for the discharge of tankers and for the refueling of ships in passage.

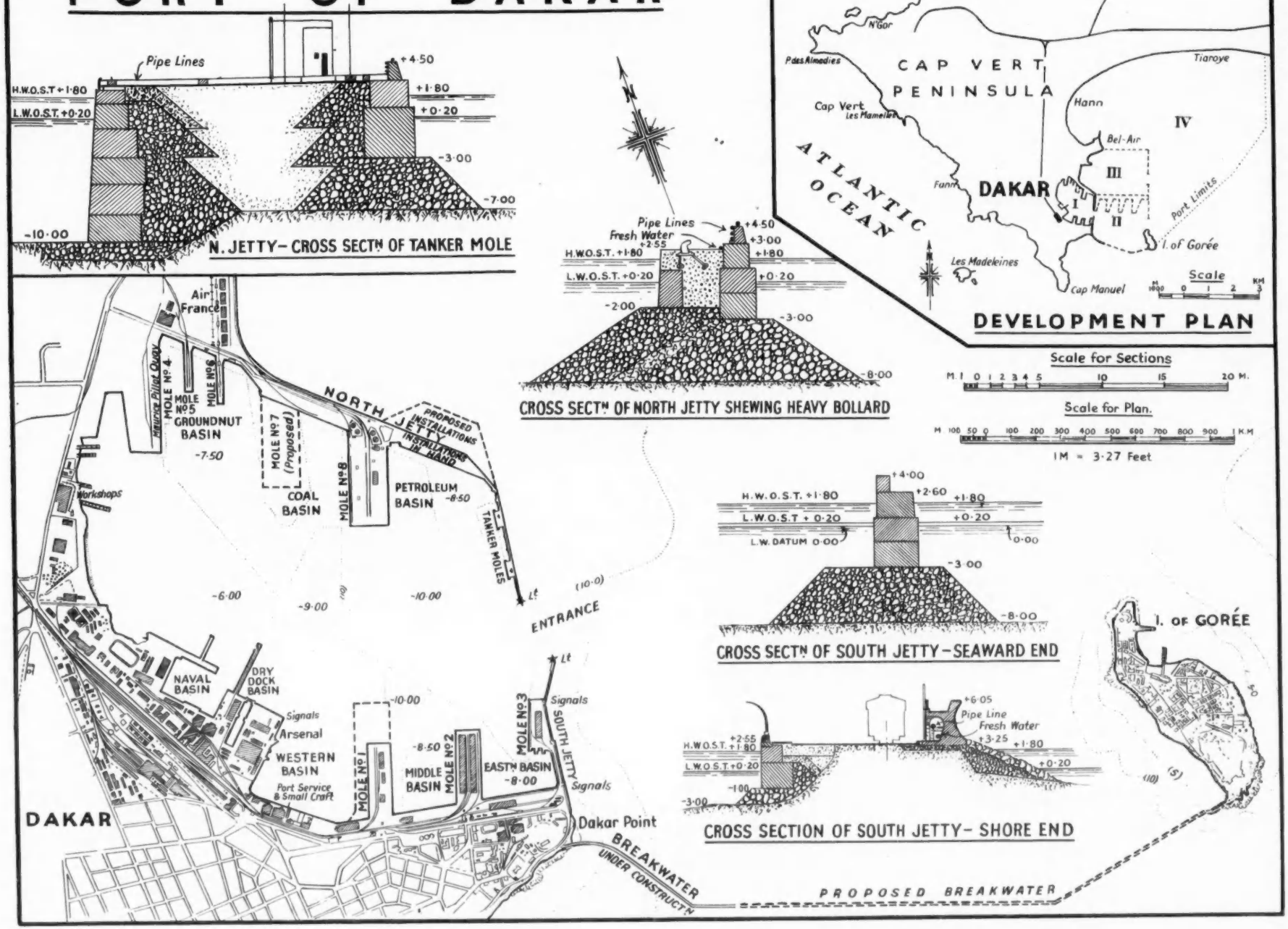
The north-east quay of the basin is provided with supply points, the outlets of which are employed for loading oil tank barges for fuelling vessels all over the port. Within the petroleum basin, in a district already well served with land communications, is the oil handling mole (Mole No. 8). This is equipped for the handling of petroleum, diesel oil and coal.

At the northern end of the port there is a large area set aside for dealing with ground nut traffic; in fact, the district between Mole 8 and the mainland has a great future. This zone will be developed progressively as traffic increases, and will deal with cargoes which arrive in large quantities, such as cement, salt, flour, timber and so forth.

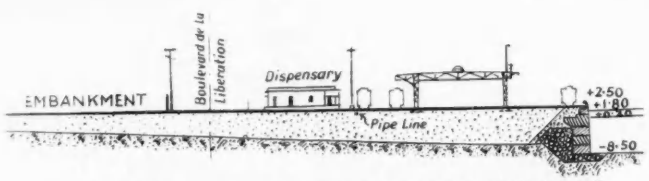
Between the northern and southern zone of the port there is a complete break on the mainland caused by the existence of the Naval Arsenal. Because of lack of funds and the existence of private property on the shore, traffic in the western zone has not been developed; here there are important ship repair workshops. The Naval Arsenal itself contributes considerably to the repair of merchant vessels and its dry dock, 200 metres long, is able to accommodate the largest liners visiting Dakar.

Finally, the entire southern part of the port can be described as the " old port," although the southern district only dates from the year 1908. This is the section of the port handling general cargoes because of the proximity of stores and warehouses; it also deals

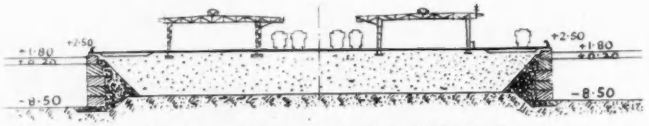
PORT OF DAKAR



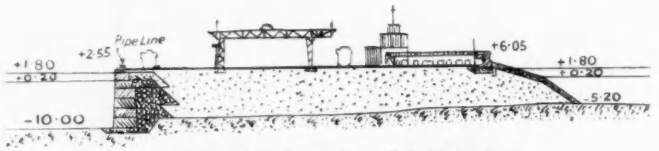
The Port of Dakar—continued



CROSS SECTION OF SOUTHERN EMBANKMT



CROSS SECTION OF MOLE 2.



CROSS SECTION OF MOLE 3.

with passenger traffic and with the fishing activities, because the town of Dakar is an integral part of the port.

Petroleum Basin

The reception of petroleum products is a very important activity; refined spirit, diesel oil and gas oil are all handled in a basin 20 hectares in area, two-thirds of which is dredged to a depth of 10.00 metres below datum, the remaining third being dredged to a depth of 8.50 metres below datum. This basin also has an area alongside the North Jetty, which is dredged to a depth of 10.70 metres below datum. This jetty is equipped for berthing two large vessels, drawing 10.00 metres and is the only place where the reception of petroleum in bulk has been authorised. On the east side of the port there are 500 metres of temporary quays with a mooring depth of four metres, the whole length of the east shore being set aside for the future construction of three oil storage depôts each with a capacity of 18,000 cubic metres.

liquid fuel at the quayside. All the outlets in the petroleum basin are arranged for both oil fuel and fresh water through a system of pipelines, the water pipes having a diameter of about 4-in.

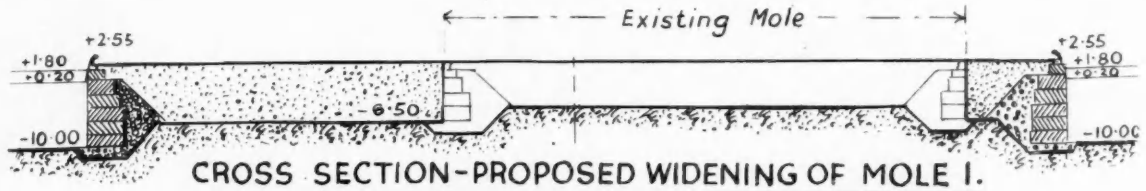
A vessel lying alongside Mole 8 can receive both fuel and fresh water at the rate of 500 tons of fuel and 180 tons of fresh water per hour, and these rates can be doubled if the ship also employs oil and water tank barges on the outboard side. In pre-war years the traffic in oil fuel exceeded 700,000 tons per annum, and the record rate of supplying a single ship with fuel has exceeded 1,000 tons an hour. Five companies participate in the supply of oil, and they are as follows: The Dakar Bonded Oil Supply Company; this supplies oil to all destinations and stores oil products. The Senegal Oil Fuel Company, whose activities are limited to the storage of oil fuel; the Mory Petroleum Company of Dakar; the Anglo-Iranian Oil Company; and the Standard Oil Company of New Jersey who are in process of installing plant.

As already stated, Mole No. 8, which is 400 metres long and 150 metres wide with a depth of water alongside of 10.00 metres below datum, is employed solely for traffic in liquid and solid fuels. Its west or windward side is reserved for the handling and storage of coal, providing a storage space for 35,000 tons and during the good years of coal traffic there was an annual throughput of 1,075,000 tons. The coal wharf is operated by the Dakar Storage Company and is equipped with two portal cranes and three railway cranes. Unloading of coal is at the rate of 3,000 tons a day per vessel and it is possible to load coal into five large ships at the rate of 800 tons an hour.

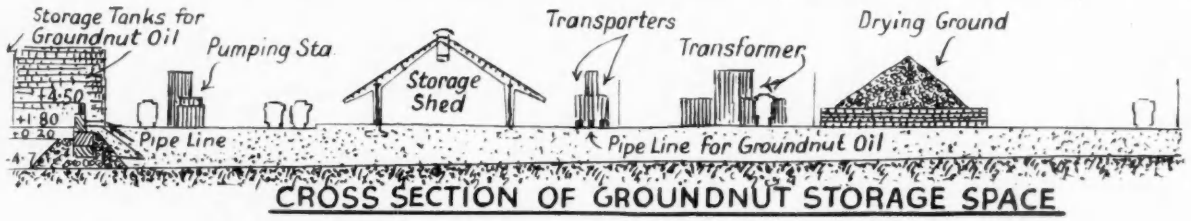
The three sides of Mole 8 are equipped with water outlets of about 4-in. diameter, and the east and southern flanks are also provided with pipelines for fuel oil and diesel oil. In order that work can be carried on at night, this mole is provided with floodlights mounted on pylons, which provide powerful illumination for the working area. The west side of Mole 8 is dredged to a depth of 10.00 metres below datum for a length of 260 metres.

There are two groups of oil storage tanks with a total capacity of 13,000 cubic metres, installed at the landward end of Mole 8 and equipped with pumping and heating plant; space has been set aside for a third group of storage tanks with a capacity of 6,500 cubic metres and these are in course of construction. The object of these storage tanks is to ensure that it will be possible to maintain the loading rate of 500 tons of fuel oil per hour at each loading point.

At present the mole has two railway tracks and sometimes has to deal with various cargoes which cannot be handled in the southern part of the port, and it is expected that there will soon be



CROSS SECTION-PROPOSED WIDENING OF MOLE 1.



CROSS SECTION OF GROUNDNUT STORAGE SPACE

The six petroleum storage tanks of 2,000 and 3,000 tons capacity for supplying ships in the southern zone of the port or at their moorings in the harbour have their supply outlets on the quays, alongside which there is a depth of four metres. The eastern and southern flanks of Mole 8 have a total length of 500 metres of quays dredged to a depth varying from 10.00 to 10.70 metres below datum, and here there is mainly storage for the refuelling of ships in passage. The latter are able to receive both fresh water and four tracks. A warehouse with a floor area of 1,000 sq. metres has been built to accommodate such cargoes and a new warehouse with a floor area of 3,800 sq. metres has recently been constructed.

Basin for Groundnuts

The basin for groundnut cargoes which is in course of construction, comprises the following: 460 metres of quays with a depth of nine metres and 350 metres with a depth of eight metres. Although

The Port of Dakar—continued

the equipment provided is still inadequate, this basin is reserved for the handling of groundnuts either in sacks or in bulk. It can be appreciated that the storage ground is very important because other parts of the port lack this facility, and in the future there should be a great increase in grain, mineral, salt, cement and timber traffic. This will alleviate such traffic in the southern zone.

The main feature of the groundnut zone is a triangular shaped area of ground covering 250,000 square metres, bounded on the seaward side by Moles 4, 5 and 6, and on the landward side by four railway tracks, a goods station and two roads. There are five reinforced concrete warehouses with a total capacity of 12,000 tons for the storage of groundnuts, and for weighing them either in sacks or in bulk. A belt conveyor with two belts, each having a capacity of 100 tons per hour, extends for 500 metres to the end of Mole 6 where vessels drawing nine metres can now be moored, and can take groundnuts from all the warehouses.

General view of southern zone and of refrigeration building on Mole 1.

Although the whole area of the groundnut basin has been dredged to a depth of only 7.50 metres below datum. The depth at Mole 6 is in fact 9.00 metres below datum, which allows a vessel drawing 8.50 metres to be moored here. This mole has a width of only 25 metres, adequate for mechanical handling and its length of 175 metres corresponds to that of the largest vessels. It is provided with pipelines for groundnut oil which is taken from the storage tanks of the Dakar Groundnut Oil Storage Company and from the Lesieur factories. Mole 5 has the same length and width as Mole 6, but the mooring depth is only 8.00 metres, which means that it cannot be employed for large vessels fully laden. It is not provided with any special handling equipment, but this will soon be developed.

Between Mole 8 and Mole 4 there are 300 metres of quay with a depth of only 1.25 metres below datum, which allows for lighters to moor alongside. Mole 4 is now in service, and is an integral part of the port facilities for handling groundnuts, and its width of 120 metres is confined entirely to this use. Its eastern portion is 460 metres long, built of honeycomb reinforced concrete blocks weighing 60 tons, and is provided with a mooring depth of 10.00 metres, but the groundnuts basin has not been dredged lower than 7.50 metres below datum, and since the mean tidal level is generally about one metre above datum, only vessels drawing less than 8.50 metres can moor at the quay at half-tide. Dredging to a depth of 9.00 metres below datum is at present in progress in the channel.

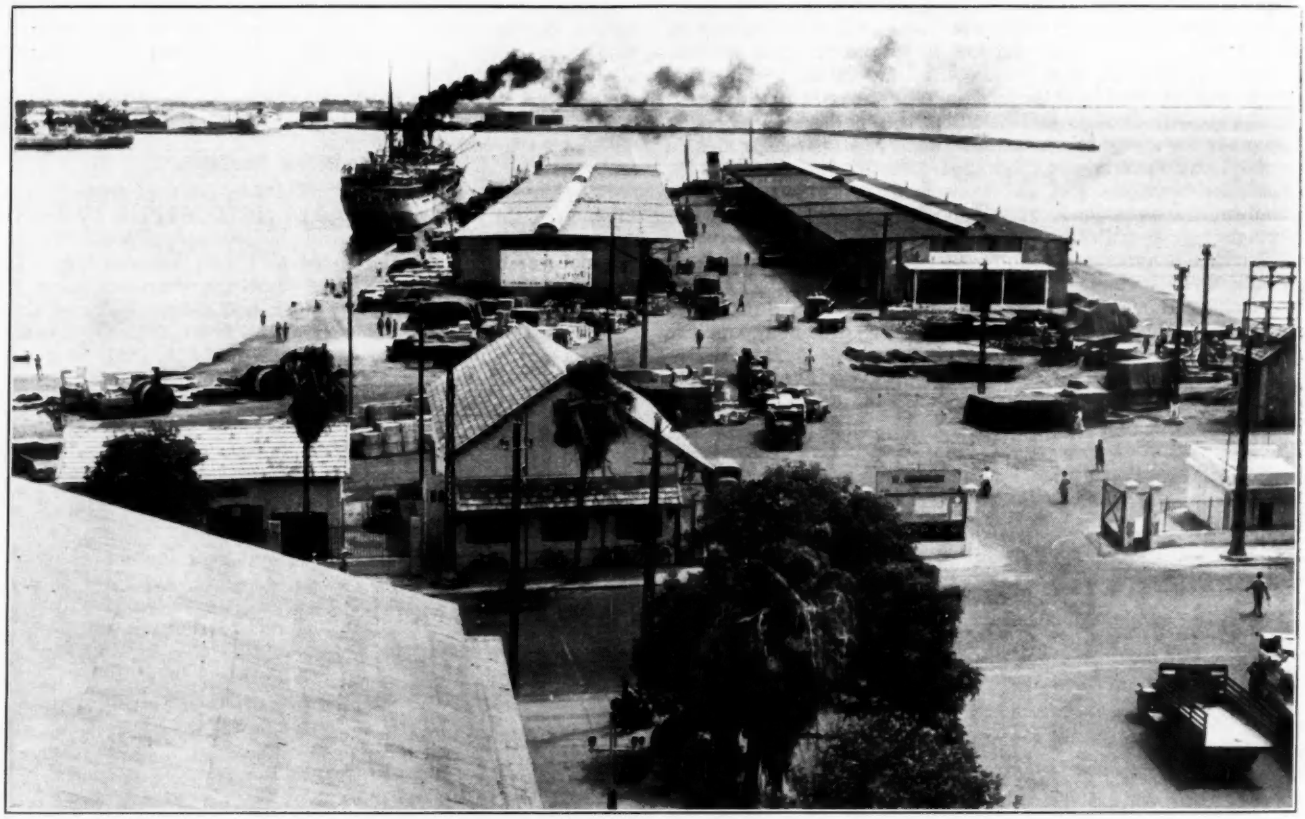
Ship Repairing Facilities

Between Mole 4 and Mole 1, for a distance of more than two kilometres, the shore is occupied by private industry, by the Naval Arsenal and by the workshops of the commercial port. This area has not yet been fully developed and there are still long lengths to be exploited, but the existing works are very important. The main feature is the naval dry dock 200 metres long, which can accommodate the largest vessels in the South Atlantic. This dry dock is surrounded by the workshops of the Arsenal, is very well equipped, and has an armament wharf 200 metres long dredged to a depth of 12.00 metres below datum. The Dakar Naval Construction Works have a slip with a capacity of 200 tons and very well equipped workshops. When repairs are carried out on large vessels, the private concerns make use of the dry dock at the Arsenal. The African Ship Repair Company has a slip of 1,000 tons. In addition to these installations, the commercial port has a small slip of 100 tons and the Port Authority operates one of 1,000 tons.

Cargoes in Southern Zone

The entire southern zone, alongside the commercial district of the town, has retained the greater part of the traffic in a wide range of goods. The different cargoes handled are as follows: packing cases, textiles, machinery and so forth; these being goods of high value which have to be safely stored and which are generally consigned to Dakar shops and business houses. From west to east and in chronological order of construction, the following are the main works which have been carried out, namely: between the Arsenal and Mole 1, the western basin has not been dredged for most of its

The Port of Dakar—continued



General view of Mole 2—Port of Dakar.

area and therefore has only slight depth. The quay on the mainland has a depth of 1.80 metres below datum for a length of 360 metres and of 6.50 metres below datum for a length of 130 metres. This is used mainly by service and fishing craft and by pleasure vessels, with the exception of that portion which is dredged to a depth of 6.50 metres which is used by the cable ship owned by the submarine cable service. The workshops of the commercial port are alongside the quays with a depth of 1.80 metres below datum.

The original Mole 1, 290 metres long and 80 metres wide, built of concrete blocks which have been heavily disintegrated by sea water since their construction in 1905, has a depth of only 6.50 metres and will be completely incorporated in a new mole which will have a depth alongside of 10.00 metres below datum, the construction of which has just started. Mole 2 is similar to Mole 1 and to the quays of the southern zone, the disintegrated concrete blocks at the top having been replaced by new concrete blocks. It is founded at a depth of 8.50 metres below datum and the basin here is dredged to that depth; it is 300 metres long and 100 metres wide. The four warehouses on this mole are each 100 metres long and 20 metres wide; they are separated by three railway tracks, of which one is on the quay side, and by a wide roadway along the centre line of the mole. There are many water outlets for supplying ships during loading and unloading operations.

Between Mole 1 and the south jetty, the quay on the mainland is similar to the quays of Mole 2; the length of this quay is 280 metres in the middle basin and 310 metres in the east basin. The width of the quay here is 70 metres, and this width will be increased by moving the customs barrier. There is a number of modern warehouses 100 metres long and 20 metres wide.

Entrance Quay

The first quay on the port quarter, as one enters the port of Dakar, is Mole 3 and the entrance quay. The foundation and dredging level here is 10.00 metres below datum, and there is a fuel oil pipeline, with outlets for fresh water and very powerful mooring bollards. This entrance quay is close to the town, the banks and post office and commercial buildings, so that travellers can soon reach the centre of Dakar.

A warehouse 100 metres long and 20 metres wide, of the same type as that on Mole 2, includes a section reserved for passengers. However, the intensity of different types of goods traffic since the war, added to the inadequacy of the equipment in the southern zone, has not allowed this quay to be devoted entirely to passenger traffic, and it will be necessary to await the reconstruction of Mole 1 before it can revert to this type of traffic.

PROJECTED DEVELOPMENT AND IMPROVEMENTS

The possibilities of extending the Port of Dakar are limitless, thanks to the exceptional protection offered by the Cap Vert peninsula and several plans have been put forward. In 1938 the first extension project began with the construction of a breakwater 2,400 metres in length connecting Dakar with the island of Gorée; unfortunately, the war interrupted this work and the financial demands upon France for the reconstruction of her devastated areas have not permitted this project to be started again, since the cost in 1949 would have amounted to about five milliards of francs.

Taking this into account the growing needs of traffic and the necessity for economy, the previous programmes were revised in 1947, and it was decided that the equipment in the sheltered part of the port should receive the highest priority. The present project is based on a ten-year programme; the annual cost amounting to about one milliard francs at least.

The following works have to be carried out in the order of urgency given :—

(1) A large dredging programme permitting access of ocean-going ships to all quays. The extension of the space ashore by moving the customs barrier, development of roads and railways, and the purchase of handling equipment, which should all help to lessen the time that ships have to spend in port. The equipment of Mole 1, which is 460 metres long and 150 metres wide, is for

The Port of Dakar—continued

various goods and for passengers, and should result in the capacity of the southern zone being doubled in the very near future. At the same time, a cautious programme of buying cranes for the existing quays is being pursued, because consideration must be given to the evolution of certain handling facilities on board modern ships, which gives them a certain independence, so far as handling cargo is concerned.

The construction of wide warehouses, accessible to vehicles, is urgent in both the north and south zones, and at present about 10,000 sq. metres are under construction. A very important refrigerated store is being built, which will be used for meat, vegetables, eggs, fruit, fish and so forth, consigned to Dakar or to the interior. One section will be entirely given over to the freezing of fish.

(2) After improvement of the southern zone and the early construction of a wet dock for naval craft, behind Mole 4, a mole for repairs will be constructed, designed to increase the output of both naval and private industry. At the same time it is anticipated that an oil wharf will be built in the petroleum basin.

A vertical silo has been designed for the groundnut cargoes at the landward end of Mole 5, which will allow Mole 4 to be used for various goods. Such a silo is expected to reduce the cost of handling groundnuts by a quarter.

(3) The construction of Mole 7 will be put in hand after Mole 1 has come into service, followed by the silo and then by the oil wharf.

Statistics and Estimates

Port activity at Dakar fell to a very low level during World War II because of the complete break with France. In 1943 the passenger traffic was only eight per cent. of that before the war; traffic in general goods was only 20 per cent. that of 1937; and the export of groundnuts fell to 4 per cent. of the pre-war figure. Since that time there has been a continuous improvement, and in 1948, the traffic in general cargoes was 94 per cent. of the pre-war figure. A summary of the trade of the port for the year 1948 is as follows:—

Number of ships	4,200	
Nett tonnage of shipping	8,436,000	
Coal	251,000	tons.
Oil fuel	802,000	tons.
Groundnuts	230,000	tons.
General cargo	780,000	tons.

During the last few years the traffic of the port has been growing rapidly, the most noticeable increase being in general cargoes. Is there any stability about this extremely important increase and will it extend into the future? Some people are doubtful about this, and think that a large proportion of the increase is due to the restocking of French West Africa to compensate for the losses suffered during the last war. This is not the view of the Directorate of Public Works, however, because an examination of the increase in general cargo traffic shows that this has taken place over a long period. In 1897, the figure was practically negligible, and the following are annual figures since that year :

80,000 tons in 1907	401,000 tons in 1937
110,000 tons in 1917	691,000 tons in 1947
275,000 tons in 1927	1,000,000 tons in 1949

The above figures show an average increase of about 7.5 per cent. per annum or 75 per cent. for a decade. This constant increase appears to be due above all to the social evolution of the country and the new needs which have arisen thereby; when stocks have been replaced, there may be a short period of delay, but the upward trend is expected to be resumed again almost immediately.

The future programme of management and extension of the port is based on the above figures; general traffic should benefit in 1958 by the existence of the new Mole 1, which will be able to handle a million tons, and from Mole 4 which will be freed from general traffic by the construction of silos, and both the oil wharf and the new Mole 7 will free the eastern half of Mole 8 from traffic.

The following is an estimate of the possible future development of the port, based on the experience of the last few years, and on the assumption that vessels will not suffer undue delay:—

Number of ships	6,000	
Nett tonnage of shipping	13,000,000	
Coal	700,000	tons.
Oil fuel	2,000,000	tons.
Groundnuts	400,000	tons.
General cargoes	1,000,000	tons.

It is therefore confidently expected that the port of Dakar will fulfil its role in being the bridgehead of West Africa.

Port Health Service Launch—Port of Dakar.

Continental Dock Labour

A Bulletin issued last month by the International Transport Workers' Federation stated that the Inland Transport Committee of the International Labour Organisation held its fourth biennial session in Genoa, Italy, from 4th to 15th December last. The meeting was attended by delegates and technical advisers representing the Governments, employers and workers of twenty-eight countries. In addition both governmental and non-governmental international organisations were represented by observers.

A wide range of questions pertaining to all the transport industries was discussed, and several committees were formed to deal with problems affecting specific branches of transport. Among them were specialists on dockers' problems who formed a small working party which submitted resolutions calling for an enquiry into conditions of employment in Continental, North Sea and Channel ports; studies on the problem of protection for dockers against dust resulting from the handling of grain; and the dissemination of information on the training and education of dock workers in modern methods of cargo handling.

The limitation of loads to be carried by one man was also discussed. Government representatives pointed out that a convention fixing a single maximum limit for the whole world was probably not practicable, and considered that technical development had reduced the need for a convention as far as ports in the industrialised part of the world were concerned. These views received support, and as a compromise, the workers' representatives, who had asked that the question be placed on the agenda of an International Labour Conference, agreed to a recommendation urging a wider use of mechanical equipment for the lifting and carrying of loads and the publication of information on the subject in sea and inland ports where human porterage is still the rule.

Consideration was also given to problems concerning the underdeveloped countries, and a resolution was adopted calling for an I.L.O. enquiry into working conditions on inland watercraft in Asia, and the submission of a report on this subject to the next session of the Committee. A further resolution called for an enquiry by field missions in Asia and Africa into the main aspects of conditions of work in inland transport, attention being drawn to the fact that the I.L.O. has at its disposal technical assistance funds which are not used as much as they could be for devising means of improving industrial relations in the inland transport industries of under-developed countries.

Welfare of Dock Workers

Report by National Dock Labour Board

Early last month, the National Dock Labour Board issued its first report on "Welfare among Dock Workers," and in a foreword, Lord Crooke, chairman of the Board, states that plans originally projected for the next twelve months provide for the expenditure of another £600,000 and further developments in 1953 and 1954 are already in the planning stage. Mr. Arthur Bird, chairman of the National Welfare Committee, in the introduction to the report states that the purpose of the booklet is to show what is being done for the welfare of dock workers in all ports, through the efforts of employers and workers in co-operation with the Board.

The Background.

The report states that there are 82,500 registered dock workers in the 84 ports included in the Dock Labour Scheme, but when the Board made a survey of dock amenities, in 1948, it was estimated that dock users—other than dock workers—in the ports within the Dock Labour Scheme amounted to some 500,000 men and women. This fact, in itself, presents a problem unique in industrial welfare. It means that the presence of such a large number of workers, employed by very many employers, requires certain common welfare facilities, such as canteens, lavatories, wash places and the like. But who is to be responsible? There is no common employer of all the workers. Consequently, if an employer provides such a service for his own men he may sometimes find that other employees for whom he is not responsible will quite naturally make use of the facilities.

The physical structure of each port creates its own welfare problems. At the one extreme are the huge dock systems, such as those at the Royal Group of Docks in London and the Gladstone Docks in Liverpool, each with several thousand dock workers; at the other extreme are individual wharves, and the small ports manned by small numbers of dockers. Clearly a welfare programme suitable for a large dock will be different from that required in a small port.

Nor is there a common factor in the social life of the dock workers. In the major ports, there is a tendency for the dock population to be dispersed away from the waterfront, and the distances now travelled by some dock workers in the larger ports from their work to home is very considerable.

It is also important to note when considering welfare on the docks that the standards of life among dock workers have been raised. Although this is part of the general raising of standards, it is more marked among dockers because of the exceptional changes in their industrial conditions during the past ten years. During the war, decasualisation became a fact; since the war, it has become permanent, through the Dock Workers (Regulation of Employment) Act, 1946. This is a social change of far-reaching significance. It has given a new status to the docker.

New Buildings.

The daily meeting place of the docker is the Call. When the National Dock Labour Corporation was set up in 1941, there were only two permanent Call Stands in existence — at Grimsby and Avonmouth; elsewhere the Call was made in the open, at the ship's side or at the street corner. To-day, in almost every port, the dock worker assembles in a covered Call Stand.

Up to the end of 1950 the National Board has spent £400,000 on Call Stands, Offices, Medical Centres, Shelters, etc. The estimate for the complete programme, at present prices, amounts to more than £1,500,000.

Dock Amenities.

In 1948, the Ministry of Transport issued a Report of the Working Party on the Turn Round of Shipping, in which it noted that in regard to dock amenities "docks generally compare unfavourably with many industrial establishments and present a drab picture."

The Minister of Labour thereupon invited the Board to make a full survey and report as to the position in all ports within the Scheme. Local Boards were asked to co-operate with Port Authorities, Employers, Trade Unions and Government Departments in making an examination of the local position and to report their recommendations as a matter of urgency. The Surveys reviewed all the amenities available to dock workers—canteens, cafés, lavatories, shelters, wash places, transport, etc.—and for the first time, a composite picture of the physical working environment of the dock worker was available.

In regard to the provision of modern lavatory accommodation, and adequate washing facilities, the report states that some Port Authorities have built new lavatory blocks, but the problem of washing facilities is not easy to resolve. Where men are handling, say, carbon black at the same berth for every cargo, it is practicable to provide adequate washing facilities—as has been done in Manchester. It is clearly much more difficult to provide showers for men working dirty cargoes which may be loaded or discharged at infrequent intervals and at a different berth each time—and most likely some distance from any place where washing facilities could be provided. As an experiment, the National Board is building two washing units in Aberdeen and Fleetwood, where it will be possible for the fish dock worker, the cargo worker and the coal porter to change clothes and have a shower on leaving work. At Workington and Glasgow there are to be smaller experimental units.

Port Medical Services.

Port Medical Centres for dock workers were first set up in Liverpool, Birkenhead and Glasgow in 1943. There are now thirty-one centres in sixteen ports; the building of five other centres will be completed shortly, and ten more are in an advanced stage of planning.

During 1947 there was a total of 128,148 treatments at eleven centres, while by 1951 the number had increased to 243,124 treatments at thirty-one centres.

The medical centres themselves are unique in design. There are four Master Plans to meet various port requirements, and in addition, first aid rooms are being built as part of some of the new Call Stands in smaller ports, e.g., Hartlepools, Goole, Port Talbot and Preston.

The Medical Staff of the Board now consists of seven full-time Medical Officers, two part-time Medical Officers, two Sister Superintendents and fifty-two State Registered Sisters.

The Board is at present making a drive to enlist the help of many more volunteers willing to be trained in first aid.

The Board also maintains a large house at Salford—at a cost of about £14,000 per annum as a rehabilitation centre for dock workers from the North of England ports. Some 1,575 dockers have attended this centre for treatment since 1947, making a total of 2,310 since it was first opened in 1943.

Social Activities.

Dealing with social activities, the report states that the growth of dockers' sports and social organisations during the past four years has been most encouraging. There has been a marked increase in the number of sporting groups since 1947. Dock workers' sporting interests are remarkably comprehensive, and more than 25,500 men are now contributing regularly through deductions from wages to these activities. During the season 1949-50 the men's contributions totalled nearly £14,000. The Board, in view of this experience, has now increased substantially the grant which it makes yearly to help finance the National Competitions, to aid local clubs and to promote further development.

Education is one aspect of welfare in which progress might have been expected to be slow, but this has proved otherwise. There has been most encouraging support both for vocational and non-vocational education. There have been eighteen week-end residential schools for dock workers and staff in different parts of the country, attended by some 900 men. The lecturers were provided, wherever possible, by the local universities, and the quality and standard of discussions have been extremely good everywhere.

The Board has co-operated with the Institute of Transport, the Port Authorities, the National Joint Council, and the Docks and Inland Waterways Executive to promote classes in the study of port working. The technical colleges in the various ports are responsible for the educational side of the classes. More than 600 dockers enrolled for the first winter's course.

Ships That Serve Ships

The History and Work of Trinity House*

By T. CLARK, M.

Introduction

IN 1514 Henry VIII granted its first Charter to a Guild of mariners or "Pilots" of the Trinity which had already been in existence for some time with functions of a semi-religious and charitable nature. The petition for the grant had pointed out that many unqualified young men and foreigners were setting up as pilots or lodesmen in the River Thames and the Charter, among other things, gave power and authority to the Guild of the Trinity to make ordinances for the relief, increase and augmentation of shipping and to enforce these ordinances by penalties.

This Charter was renewed by each Sovereign in succession, with or without variations, that of James I (1604) laying it down specifically that no persons should take upon them to be Pilots in the Thames unless they were so appointed by the Corporation.

The amplified Charter of James II was granted in 1685, thanks largely to the influence of Samuel Pepys, that indefatigable Secretary to the Navy, who twice served as Master of the Corporation, and, so far as pilotage in the Thames was concerned, laid down that pilotage of foreign ships was compulsory and gave to the Corporation the exclusive right to license pilots.

The whole question of pilotage was made the subject of an enquiry early in this century and the Pilotage Act of 1913 provided for the reorganization of this important service with a view to securing uniformity of administration so far as practicable.

Today, Trinity House is the Pilotage Authority for the London District, an area which extends from London and Rochester Bridges to the Sunk Sand off Felixstowe in the north and to Dungeness in the south, as well as for some forty ports in various parts of England and Wales, including Southampton (these Outports having been created in 1808. Its duties comprise:

(a) the examination and licensing of pilots;

(b) the granting of pilotage certificates to masters and mates of British ships; and

(c) the provision of a sufficient supply of licensed pilots for the ports concerned.

There are nearly six hundred pilots licensed by Trinity House but it must be understood that they are not the servants of the Corporation. The Pilotage Service is administered through the London Pilotage Committee on which the ship owners and pilots have a representative, so far as concerns the London District, and through sub-commissioners at the other ports. Certain ports, including Liverpool, have pilotage authorities independent of Trinity House.

Pilot Cutters

The term "Pilot Cutter" is, of course, a heritage from the days of sail. Many of the vessels which today bear the name are over 140 feet in length and a few are over 150 feet in length.

The duty of a modern pilot cutter is simply to act as a floating base at the approaches to ports and estuaries from which a pilot may be "picked up" or to which a pilot may be "dropped" as required.

Where there is a considerable volume of traffic, provision must be made for a large number of pilots and thirty are accommodated on the larger pilot cutters in two berth cabins. A dining saloon and comfortable lounge are also provided entirely separate from the accommodation for the master, officers and crew. With modern facilities in the way of bathrooms, and washplaces and galley, it will be appreciated that the vessel, except for navigating bridge, machinery spaces and boat deck, is almost entirely subdivided into accommodation.

Pilots take their turns in rotation to board incoming vessels requiring their services and subsequently, when landed, take their turns in rotation to board outward bound vessels. Then when once more abreast of the pilot cutter they are "dropped" to resume the period of waiting until inward bound again. Radiotelephone communication between the pilot cutter and the shore is maintained to ensure, among other things, that pilots are available in adequate numbers for incoming vessels.

Two boarding motor boats are carried, each 18-ft. long but designed for use in heavy weather to transport the pilots between the cutter and the vessels awaiting or finished with their services. These boats have to be launched in any weather and shock absorbing gear is fitted on the davits or arranged in the lead of the falls. As an additional precaution, the boat winch is of ample power to give a rapid speed of hoist.

Propelling Machinery

Pilot cutters on station lie at anchor when possible, but at other times the engines are used to maintain position. The variety of of propelling machinery installed on the vessels ranges from a single-screw triple expansion steam reciprocating engine to twin-screw Diesel machinery of 800 collective brake horse power. One of the smaller pilot cutters, 101 feet in length overall, has a Diesel-electric installation in which power is obtained from three London bus type engines running at 1,650 revolutions per minute to give 225 collective shaft horse power at a single propulsion motor which is controlled from the bridge.

Lighthouse Service

A lighthouse is usually pictured as a lofty tower erected on a headland or isolated rock at sea. It acts as a seamark by day and displays by night a powerful light. Add to this the ability to produce the most efficient sound and wireless signals that can be devised and the result is a lighthouse of modern times in its most perfect form.

At sea it is not always possible to secure a firm foundation where, for the safety of shipping, a seamark is essential. The seabed may consist of unstable drifting sands, or the depth of water over isolated rocks may rule out any practical hope of building a permanent structure, and it is necessary to use some form of floating mark instead. Buoys of various types are used as floating marks, but the provision of a major light accompanied by a powerful fog signal is essential, in many instances, for adequate protection and this need can be met only by mooring a light vessel in the required position.

Light Vessels

Britain led the way in the use of lightships to mark sandbanks where lighthouses could not be built, the first being placed at the entrance to the Thames in 1732 to mark the Nore Sand. By 1795 four other dangerous shoals, including the Goodwin Sands, had been marked by lightships. These early vessels exhibited fixed lights from simple lanterns containing four to six candles. One, two or three lights in various combinations on separate masts enabled the particular station to be identified. Although they were strongly built, these early vessels had to ride out the winter gales on hemp cables and it was not unusual for them to break adrift. They were rigged with sails for use in emergency but an attendant vessel in the nearest port had to be maintained to supply new cables and restore the lightship to its position when necessary.

The introduction of chain cables in 1820, important as it was for shipping in general, had even greater significance for light vessels which depend so much on a safe mooring. Longer vessels were built, in which greater comfort for the crew became possible, and space was made available for the development of the navigation light and fog signal equipment concurrently with the development of ship construction.

*Paper read before the Institute of Marine Engineers, November 1951, and reproduced by kind permission.

Ships that Serve Ships—continued

Fig. 1. A modern light vessel.

Wooden hulls gave way to composite construction, to iron and, in due course, to steel hulls. It is, however, worth pointing out that three of the later-built wooden hull vessels and seven composite vessels are still in service, improved where possible to meet modern standards for accommodation.

Modern Light Vessels

Figure 1 shows in profile a modern light vessel of which the principal particulars are as follows:

Length overall	... ...	137-ft. 3-in.
Breadth, moulded	... ...	25-ft. 0-in.
Depth, moulded	... ...	15-ft. 0-in.
Mean draught	... ...	10-ft. 11-in.
Displacement	... ...	515 tons

It will be seen that the lantern is carried on a steel lattice tower amidships. Forward of the lantern tower a look-out shelter with all round vision is provided and on top of this shelter the diaphone fog signal is erected above all obstructions which could possibly blank the sound. The foremast and mainmast carry the radio telephone and radio-beacon aerials, and they have also been used to display daymarks, large conical or globular shapes, to assist identification in daylight. The station name is exhibited each side of the vessel in letters 6-ft. high and, as the topsides and lantern tower are painted Post Office red, the vessel can readily be identified from a distance in clear weather.

Light vessels are not self-propelling but are moored at their stations and the windlass is of necessity robust in construction. A rotary engine of 35 h.p., driven by compressed air, supplies the power required for working the windlass but hand gear is also fitted for emergency use. In addition to the main riding cable, two anchors are carried at main deck level in recesses built in the forward bulwarks (Fig. 2). These anchors re arranged with special releasing gear so that one or both of them can instantly be let go in the event of the permanent mooring carrying away in a gale. It should be said, however, that very few instances have occurred when the standby anchors have had to be brought into use.

The machinery for current supply to the main navigation lantern and for ship's lighting is housed in the engine room amidships (Fig. 3). For lighting purposes four single cylinder Diesel engines directly coupled to 5½-kW., 100-volt D.C. generators are installed; each engine develops 9½ b.h.p. at 1,000 revolutions per minute and, under normal conditions, one set is sufficient to supply the load requirements. A second set may be necessary in certain circumstances, leaving one machine available as standby, should one be dismantled for servicing.

Two fog signal sets are fitted to provide compressed air supply for the diaphone. These sets consist of a Diesel engine developing 38 b.h.p. at 1,000 revolutions per minute with a drive through flexible couplings to a 5½-kW. generator and through a multi-groove Vee pulley and belt drive with clutch to a quadruplex air compressor. The Diesels are fresh water cooled in conjunction with a sea water circulated heat exchanger.

The quadruplex single stage air compressors have four cylinders arranged radially in a circular casing. Each cylinder is fitted with a trunk piston driven by connecting rods from a common crank pin. An annular space forming a water jacket is contained in the casing through which the cylinders pass. In effect each cylinder forms a separate single acting compressor delivering into a common passage so that at high speed a steady stream of air is discharged.

The compressor has no suction valves, air being admitted to the cylinders through ports in the piston which coincide with similar ports in the top of the connecting rod during the suction stroke and at the end of the suction stroke, the piston uncovers ports cut through the cylinder wall so making direct communication between the cylinders and the suction chamber formed in the casing. Delivery valves are fitted at the outer end of each cylinder and they open during the compressing stroke when the air has reached the required pressure.

Three air receivers each of 220 cu. ft. capacity are arranged in the engine room for the storage of air at a maximum pressure of 120-lb. per sq. in. This air supply is reduced in pressure to 35-lb. per sq. in. for use in the fog signal diaphone and the windlass engine, the low pressure air being stored in two small receivers on the main deck.

Lantern

The lantern, carried on a lattice tower, is a fixed structure which houses an optical system of the catoptric or mirror type. The arrangement consists of a pendulum supported on gimbals, balanced and designed so that it will have a rate of oscillation just out of step with the natural period of the ships' roll. By this means the light beams are kept horizontal although the light vessel may be riding and pitching heavily in a seaway. Above the pendulum pivot point, four groups of two focus mirrors are arranged each with its own 500-watt lamp. The mirrors can be set in various positions so that the beams from any pair are disposed in the desired relationship to the beams from the other pairs. By this means the light can be given differing characteristics and single, double, triple or quadruple flashing combinations can be produced. The advantages of this system are obvious as a lightship may have to be used first on one station and later on another station.

The optical system is revolved by a small electric motor through a shaft mounted on journal and thrust bearings and by means of of change gears the speed of revolution can be made one in fifteen seconds, one in thirty seconds, one in sixty seconds, one in ninety seconds or one in 120 seconds. The current is conveyed to the lamps by slip rings. The lantern focal plane is forty feet above sea level at normal load draught and the light is visible in clear weather for a distance of approximately twelve miles.

Diaphone

The fog signal diaphone is operated by compressed air. A gunmetal piston is made to oscillate in a cylinder by introducing compressed air at a pressure of 35-lb. per sq. in. to the rear chamber of the diaphone casing through an operating valve. The piston and cylinder contain a series of annular slots cut over the larger part of their length and the outer end of the piston is open to a resonator which is a trumpet mounted vertically and fitted with a large mushroom head to give all round distribution of sound. Air at the same pressure, 35-lb. per sq. in., is introduced through a sounding valve to the front chamber of the casing and as the piston oscillates the annular slots on the piston and cylinder coincide, so releasing pulses of compressed air into the resonator. A large volume of sound at approximately 180 cycles per second

Ships that Serve Ships—continued

is produced. A timing mechanism controls the sequence of the operating and sounding air valves, and the mechanism can be set to give any desired character and length of blasts.

General Features and Wireless Aids

Light vessels, lying moored as they are at the converging points on busy shipping lanes, quite frequently sustain damage by collision. The point of impact in many cases is on the bow and for this reason particularly heavy construction in this area is essential. The sloping bow and high bow bulwark, which is a feature of modern light vessels, is capable of absorbing heavy damage, thus preventing so far as possible, injury to the underwater bow plating. In case of serious damage, however, the inboard ends of the riding and anchor cables are secured on the main deck by slips which can readily be released if it is essential to let go the cables to lighten the vessel. An efficient alarm bell system is provided to warn the crew of approaching danger.

Two signal guns are carried, fired through gunports in the after main deck bulwarks. Their function is to provide visible and audible warnings by the production of a large volume of smoke and sound to warn any craft approaching into danger. Explosives for the signal guns are carried in magazines built at the stern of the vessel.

Wireless aid to the navigator is given by radio-beacon transmitter which performs two functions:

(1) To transmit in clear weather a radio signal having a definite characteristic by which the light vessel can be identified and at the same time to enable a bearing to be taken.

(2) To transmit during fog or haze the radio signal which identifies the light vessel at precisely the same instant as the diaphone fog signal begins to sound. By this means the navigator is enabled to estimate his distance from the light vessel using as a basis for the estimate the known difference between the speed of sound and the speed of wireless waves. The number of seconds elapsing between the times at which the radio-beacon and sound signals are heard can be readily converted to distance from a suitable table of figures previously prepared. It is pointed out, however, that varying atmospheric conditions can alter the time taken to receive the sound signal and it is not now considered so desirable to synchronize the diaphone with the radio-beacon.

An automatic code-sender governs the Morse characters of the transmitter by operating make and break contacts to form the characteristic of the radio-beacon. The code-sender is itself controlled by a master clock which times the beginning and duration of each group of signals. The master clock and code-sender also govern the timing of the diaphone fog signal. The radio-beacon is in duplicate and in the event of failure the standby unit can be switched into circuit without interruption of transmission.

The accommodation for the Master consists of a day cabin with adjoining sleeping cabin and a separate washplace. The crew of six men is accommodated in two berth cabins with separate messroom and modern facilities are provided, including an electric refrigerator, hot and cold fresh water supplies, and central heating by hot water radiator system. Steel light vessels are required to remain on station for a minimum period of three years and for this reason separate accommodation is also provided for two Trinity House workshop mechanics when on board for maintenance work.

Communication with the shore and with other light vessels is maintained by radio-telephone.

Unmanned Light Vessels

Unmanned light vessels or light floats vary in length from about 45 feet to 65 feet. They are fully decked and suitably compartmented to give a good chance of survival in the event of being damaged by collision. An automatic acetylene light is carried on a lattice tower. An automatic bell fog signal operated by compressed CO_2 gas acting on the striker is usually fitted, sometimes with the addition of a wave-operated bell signal.

Two unmanned light vessels are in service at the present time, both 65-ft. long on the load waterline. They have low bulwarks forward but elsewhere the deck is open and rounded at the margin into the shell plating so that any water which has been shipped will escape freely overside.

A watertight hatch is fitted over each compartment and ventilation is arranged by means of watertight gooseneck ventilators. At the outlet end of each gooseneck is arranged a non-return valve consisting of a light composition ball and a brass seating ring. The ball in its normal position leaves the compartment below open to atmosphere but when the ventilator mouth is submerged by a sea the ball is floated up on its seating and effectively seals the ventilator.

The light is of the open flame type in which a small pilot light burns continuously. The dissolved acetylene gas illuminant is fed to the burner by means of a flashing mechanism controlled by a diaphragm chamber into which the gas is fed at a pressure of about 450-lb. per sq. in. The gas distends the diaphragm in a predetermined time and the movement of the diaphragm, magnified by suitable lever and fulcrum, opens the supply valve and admits gas to the burner, where it is at once ignited by the pilot light. The pressure in the diaphragm chamber is reduced by the release of gas to the burner and the diaphragm moving inwards closes the burner supply valve, so restarting the cycle of operations.

Lighthouse Tenders

Nine lighthouse tenders are stationed around the coast at six depots, from which the work of lighthouse maintenance for each of the six districts is supervised by the District Superintendent acting under the overall direction of the Chief Superintendent and the Elder Brethren of Trinity House. The lighthouse tenders are

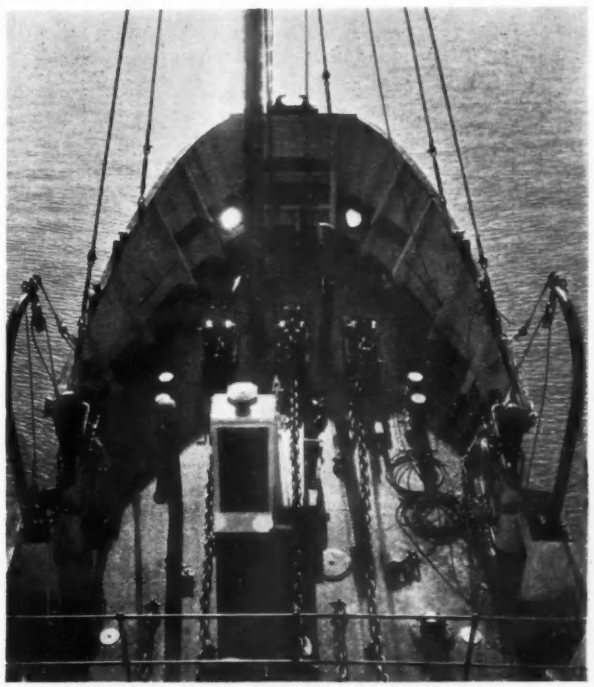


Fig. 2. Foredeck of a modern light vessel looking from steering shelter.

of varying length, ranging from 165-ft. 9-in. to 256-ft. overall but are generally capable of performing the same manifold duties. T.H.V. "Argus," a tender of modern type, is show in Fig. 4. Certain particular duties are more efficiently performed by individual vessels, natural in a fleet of vessels so diversified in type.

The propelling machinery also varies widely in character. Three twin-screw tenders are fitted with triple expansion reciprocating engines supplied with steam from two Scotch boilers. Three other twin-screw tenders are fitted with triple expansion reciprocating engines supplied with steam from two oil-fired Scotch boilers. One twin-screw tender is fitted with Diesel-electric propulsion, another with reciprocating engines supplied with steam from oil-

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fired watertube boilers and, lastly, one is single-screw with triple expansion steam engine and one large Scotch boiler of trawler type.

The diversity of propelling machinery is reflected in the auxiliary equipment and the author therefore proposes to describe some particular features of lighthouse tender rather than attempt to describe one or all vessels in detail. It may be appropriate to digress at this stage so that something may be said of the duties which a lighthouse tender has to perform.

Maintenance work in the Lighthouse Service consists of a wide variety of operations and some of the duties carried out by the lighthouse tenders are as follows:

(1) The relief of lighthouses and light vessels, which consists of a regular fortnightly trip on which relief crews are transported to and from their stations and supplies of oil, fresh water, coal and general stores are replenished.
(2) Maintenance of the buoyange system which demands that every buoy shall be lifted at regular intervals, cleaned, painted, equipped with fully charged gas cylinders for the light where fitted, and inspected generally to ensure that the light is efficient and that the mooring chain and sinker anchorage are satisfactory.
(3) Light vessels have also to be relieved from their stations at regular intervals for repair and the lighthouse tenders, after towing the relieving vessel to her station and mooring her there, take the relieved vessel in tow to her depot for de-storing in preparation for drydocking and repair.
(4) Wrecks have to be marked as soon as possible after the occurrence.
(5) Sandbanks, suspected to be extending, must be surveyed to ensure that their limits are adequately marked.

Reliefs

The day before the relief is due to begin the lights officers' and lightsmens' gear is loaded aboard the tender. The word "gear" in this case covers many items, food for every man to last until the next relief, sea kit of warm clothing, oilskins and seaboots, writing materials, perhaps some books and probably a half-completed mat, wool rug or ship's model on which to work as a hobby during off-duty spells afloat. In the hold of the tender are separate bins for each light vessel and in each bin are stowed personal belongings and food for the men. General stores for the light vessels such as coal and anthracite, paints and cleaning materials, are loaded in the hold. Diesel fuel and lantern illuminant oil in deep tanks and fresh water in the double bottom tanks, to replenish supplies on all the light vessels which are to be visited, complete the stores. The relief crews, comprising twelve lights officers and twenty-four lightsmen, are accommodated in their own separate quarters on board and the relief is ready to begin.

On arrival at the first light vessel the tender draws up and makes fast astern. Oil and water hoses are passed to the light vessel and the electric motor-driven pumps on the tender which are controlled from the fore deck are set in operation. At the same time one of the two motor boats has been lowered and the relief crew with their stores are transported to the light vessel. The men who have been relieved are brought back to the tender with their belongings, after which the motor boat transports coal and other stores until all is delivered.

During the course of the relief, which is carried on throughout the day and night, the commanding officer and chief engineer of the tender go aboard each light vessel to carry out an inspection. The hull, deck fittings and lifesaving equipment are examined by the commanding officer. The machinery is inspected by the chief engineer and any essential adjustments or repairs are taken in hand.

Emergency repairs and adjustments of this kind are part of the relief work and not to be confused with routine maintenance of the fog signal machinery and electric generating plant, which is carried out by a staff of Trinity House mechanics from workshops at Blackwall, London.

Buoy Work

Fine weather is much to be desired for buoy maintenance work and every effort is made to complete a large part of the maintenance programme during the summer months. Over 600 buoys have to be dealt with and on fine days work goes on from dawn to dusk. It is known from the records that buoys are likely to need new moorings or perhaps withdrawal for major repair and the lighthouse tender is loaded accordingly with clean buoys of the correct size and shape, each suitably painted in the colours and pattern by which it is identified in its particular position. New mooring chains are loaded through chain pipes and ranged in the bottom of the hold, ready to be quickly paid out as required, and the auxiliary equipment such as buoy lamps and the wooden superstructures on which they are carried, acetylene gas cylinders, gas mantles and buoy sinkers are suitably stowed. These sinkers, which provide anchorage for the buoys, are round or oval cast iron slabs weighing up to three tons and having a heavy steel eyebolt cast solid in the centre to take the mooring chain.

The lifting gear of a modern lighthouse tender consists of a steel derrick, having a safe working load of twenty tons, pivoted on a table aft of the foremast. Two hoisting engines are installed on the lower deck, one for purchase and the other for topping the derrick. Each hoisting engine consists of a 60 h.p. twin-cylinder vertical steam engine driving through worm gearing a winch barrel on which 250 feet of $4\frac{1}{2}$-in. circumference flexible steel wire rope is laid and unlaid by automatic spooling gear. A pull of $12\frac{1}{4}$ tons at 30-ft. per min. can be exerted on the first layer of rope off the barrel and by means of a single sheave purchase block 20 tons can be raised at 15-ft. per min. A volute spring shock absorber is fitted between the purchase block and the hook. The derrick guys are treble purchase blocks rove with manilla falls and operated by a 30-cwt. electric capstan at each side of the hatch.

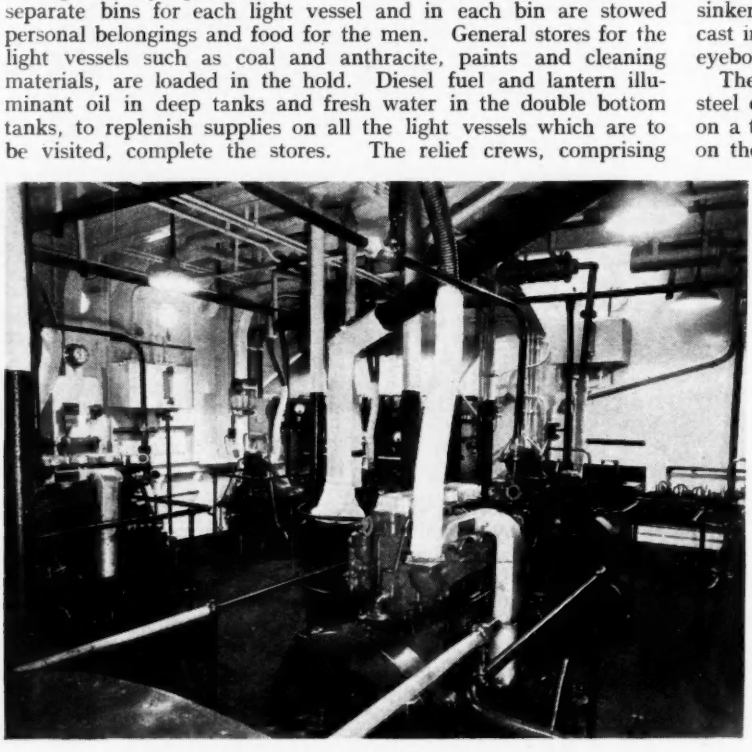

Fig. 3. Lighting and fog signal machinery compartment.

A capstan suitably positioned on the centre line is used in conjunction with the derrick to handle buoy mooring cables. This capstan has a single head on which cable lifters of various sizes can be fitted and, above the cable lifter, a warping barrel. A 60 h.p. twin-cylinder steam engine fitted on the deck below drives the capstan through spur and bevel gearing. Derrick engine and capstan controls are arranged on the upper deck.

When buoy shifting is in progress the fore deck resembles a busy workshop. The tender having run a little way up tide or up wind of the buoy drops an anchor and falls back on the cable until the buoy is riding nicely placed athwart the fore deck working gangways. The derrick is swung overside and, by means of a two-legged

Ships that Serve Ships—continued

sling hooked into the lifting lugs either side, the buoy is raised and swung inboard. The weight of the mooring cable is taken by a stopper secured on the foredeck so that the buoy can be landed.

Thereafter several operations are carried on simultaneously. The position of the buoy is checked to ensure that it has not dragged. The heavy weed and shell growth on the underwater surfaces of the buoy are removed and hosed overboard. The four apertures, each containing a cylinder of dissolved acetylene gas illuminant are opened up, cylinders removed and replaced with fully charged cylinders. Whatever is necessary to fit the buoy for at least one year's service is done, the lamps and flashing mechanism are tested, mooring cable examined and if need be lifted and replaced. Finally, when the buoy has been repainted it is lowered overside.

Buoys which carry a light are as a rule five tons in weight and with the mooring chain and other fittings the load on the derrick is about seven tons. Another class of buoy which carries a more powerful light on a lattice tower is known as a high focal plane buoy and with its fittings and mooring cable it weighs approximately twelve tons. It will be readily appreciated that the movement of a buoy and motion of the tender in even a moderate sea imposes very heavy stresses in the lifting gear.

An interesting feature of some high focal plane buoys is the long cylinder attached to the underwater body. As the buoy rises in a seaway, air is drawn into the cylinder, to be forced out at low pressure through a whistle as the buoy dips again.

Light Vessel Moorings

The modern gear for handling light vessel moorings consists of a triple head capstan mounted on the foredeck. The capstan heads are interchangeable and lifters can be fitted to a deal with various sizes of cable. The capstan heads are driven by a 60 h.p. twin-cylinder steam engine installed on the main deck below and each head can be worked independently of the other two. Chain pipes from the lifters lead direct to the bottom of the hold where new cables are ranged and a strongly constructed roller or ramp in the bow of the lighthouse tender takes the lead of the mooring overside.

A suitable mooring for the majority of light vessels is provided by a 5-ton stockless anchor connected to 210 fathoms of $1\frac{5}{8}$-in. diameter stud link cable, but for very exposed stations $1\frac{3}{4}$-in. diameter stud link cable is used. The length of 210 fathoms, which is rather longer than that in use in merchant ships, is required to form a catenary to which the light vessel can ride easily without snatching on its mooring. It is customary to ride with 180 fathoms of cable out in bad weather.

Towing

For towing light vessels to their stations and bringing them in when necessary for overhaul, the tenders are fitted with a towing winch of which one, an automatic veering and hauling winch, is fitted on a vessel with Diesel-electric propulsion machinery and consequently is operated by compressed air. The winch engine is of 60 h.p. built-in conventional steam winch arrangement with two horizontal cylinders driving a barrel through helical gears. On the barrel 120 fathoms of $4\frac{1}{2}$-in. circumference flexible steel wire is laid and unlaid by automatic spooling gear. It is customary to connect the towing hawser to one of the cables on the light vessel so that by paying out cable to suit the weather conditions a catenary is formed to ease the fluctuations of stress in the towing hawser. By this arrangement the anchor cable also takes the nip and chafe at the mooring pipe on the light vessel instead of the hawser, which is less able to sustain prolonged chafe. The lead of the hawser from the tender is taken through a towing roller consisting of one horizontal roller flanked on each side by a vertical roller.

When the tow has been set to the desired length the automatic veering and hauling gear is engaged by a clutch on the towing winch. The operation of this gear is somewhat similar to the hunting gear on a steering engine. When the pull on the towing hawser increases, the winch renders and pays out, so relieving the stress. The movement of the barrel is transmitted through gears to the control valve which is opened to admit more compressed air to the cylinders until balance of power is reached. As soon as the pull on the hawser eases the winch engine takes charge, winding in the hawser again to the length at which it was originally set.

Fig. 4. Trinity House tender *Argus*

The remainder of the auxiliary machinery in a lighthouse tender follows generally the same lines as that in vessels of similar size, except for the workshop, wherein lathe, drilling and shaping machines, grinding machine and power saw are provided to facilitate urgent lighthouse or light vessel machinery repairs.

Special Duties

The Trinity House vessel *Patricia* carries out all the normal routine work of a lighthouse tender but has in addition other special duties to perform. Each year an inspection of all lighthouses, light vessels, beacons and buoys is carried out by a visiting committee of the Elder Brethren in *Patricia* which is fitted with accommodation for this purpose.

The Elder Brethren also attend in person on the Sovereign when proceeding on, or returning from, a voyage across the sea and on ceremonial occasions such as a Naval review when the Trinity House vessel *Patricia*, with the Elder Brethren on board, may be seen leading the Royal yacht.

Propelling Machinery

The propelling machinery of T.H.V. *Patricia* is Diesel-electric and is one of the earlier applications of this type of equipment for marine use, having been built in 1938.

Two six-cylinder four-stroke Diesel engines with mechanical injection, each of 750 b.h.p., are direct coupled to 550-volts direct current separately excited propulsion generators and a 48-kW. overhung generator supplying current, for auxiliary purposes at 220-volts D.C. The main propulsion generators are of the open self ventilated type having rotatable frames carried in cradles to

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provide for easy removal of the lower poles. Means are provided for measuring the wear down without dismantling the bearings.

The propulsion motors are capable of delivering 665 s.h.p. on each of the two shafts at 200 r.p.m. and are of the single armature type with separate pedestal bearings independent of the thrust shaft. Separate motor-driven ventilation fans which start up automatically when current is supplied to the propulsion motors are fitted, to discharge air axially over each commutator.

Control Equipment

Independent control for each propulsion motor is provided from the navigating bridge and from the engine room and electric tachometers to indicate the propulsion motor revolutions and direction are fitted at each of these control stations.

The bridge controllers are in the form of telegraphs and provide six ahead speeds and four astern speeds. Features are embodied in the control scheme which, without any interruption of power, make it impossible to overload the main generators under any conditions.

Independent control of the two propulsion motors can be maintained with one or both generators in operation. Changeover switches are provided for transferring the control from bridge to engine room and pilot lamps at each station indicate which controller is in service.

The exciter sets are in duplicate, each unit comprising a motor of 30 b.h.p., driving one main generator exciter and two propulsion motor exciters. Control of the propulsion motors is carried out by varying the fields of the generator exciter and the propulsion motor exciters.

It is interesting to note that after thirteen years in service the liner wear on the Diesel engines does not exceed 15/1,000-in., a point which indicates fairly well the advantages to be obtained with constant running Diesels as opposed to those frequently started up by compressed air for manœuvring.

In conclusion the author realises that, within the scope of so short a summary, it has been possible to touch only superficially on many aspects of the subject, but it would scarcely be appropriate to conclude without reference to the men who serve in the "Ships that Serve Ships." For the aids to the mariner depend ultimately on the reliability of the men at their stations and we who live by the sea know the value of their work for us and for all who navigate the sea.

Turn-Round Delays to Ships in Port

Statement by International Chamber of Shipping

At a meeting of the International Chamber of Shipping, held in London on January 16th last, one of the subjects discussed concerned the problem of delay in the turn-round of ships in port. The meeting noted the decision of the International Chamber of Commerce to study the subject from the users' angle as part of its programme of work. As representing the industry primarily concerned, the meeting expressed its willingness to co-operate with the I.C.C., and adopted the following memorandum setting out its views on the wide field of issues involved.

Statement on Turn-round of Shipping

(1) This problem is one of the main pre-occupations of shipowners in all maritime countries. Slow turn-round is not common to all countries or to all ports; indeed in some, turn-round is now as good or even better than in the past. But where delays in port exist, the countributory factors remain, in general, largely unresolved and the need for continued study of the problem and further action cannot be over-emphasised.

(2) In an appreciation of the root causes underlying slow turn-round, shipowners confirm that the main factors common to most ports concerned are those mentioned specificially in the recommendation of the Council of the Organisation for European Economic Co-operation at its meeting in August, 1951, namely:—

(i) inadequacy of port and clearance facilities in relation to the volume of cargoes handled, and

(ii) local labour conditions.

In considering the first of these two main factors it has to be borne in mind that there is a tendency for ships to concentrate on fewer main ports. This tendency is to some extent a normal development due to an increase in the average size of ships and other economic considerations. It is, however, aggravated by the centralising influence of bulk trading.

(3) While the nature and degree of these root causes of slow turn-round differ in particular countries and in the individual affected ports, the following are among the principal reasons under these two main headings for the serious position which exists to-day:—

(1) Insufficient berthage, warehouse and transit shed accommodation at certain large ports, with resultant congestion. In some countries this insufficient accommodation is due to unrepaired war damage In other cases facilities would have been much more inadequate but for the help of E.C.A.

(2) Failure in some ports to clear goods from transit sheds quickly enough;

(3) Inadequate internal transport facilities to and from a number of ports, aggravated by shortage of railway locomotives, wagons and lighters;

(4) The need for more mechanisation and modern port appliances;

(5) Labour problems, including:

(a) shortage of labour at peak periods;
(b) restrictive practices;
(c) failure to make maximum use of existing mechanical appliances;
(d) disadvantage of pooling, i.e. dilution of specialised gangs, loss of personal interest in the job;
(e) opposition to overtime or to shift-working or to incentive payments;
(f) indifferent discipline due to various causes.

(4) As most ports are in international use it will continue to be of first importance that the views and practical suggestions of all users should be made known, but in the main and more especially to the extent that the causes of slow turn-round have a material or physical origin, their solution depends on national or local action.

(5) But in relation to those aspects of the problem which involve the human factor, every opportunity must be taken, whether locally, nationally or internationally, to secure a fuller realisation by all those who repair, load or discharge ships that, not only as workers in the repair yards and in the ports but also as members of the community at large, they have much to gain and nothing to lose by an improvement in output.

At the same time it is very necessary that those concerned should re-double their local and national efforts to ensure that the conditions of employment and the systems of administration are the most conducive to the greatest effort.

(6) The International Chamber of Shipping is, therefore, of the opinion that very largely the solution of the problems inherent in the slow turn-round of ships in port is to be found through local and national action. It will, however, continue its close study of the matter in co-operation with the International Chamber of Commerce.

Sunderland Radar Installation.

The River Wear Commissioners have decided to continue to operate the shore-based radar equipment which was installed by Messrs. Kelvin and Hughes (Marine) Ltd. on an experimental basis in 1950. After studying a report on the experience gained, the Commissioners are satisfied that the installation has proved its value as a navigational aid for the pilotage of vessels entering and leaving the harbour during periods of fog, when it has facilitated shipping movements and also has proved valuable in giving warning to vessels which have approached too far inshore.

Radio Speech Communication

Systems for Harbour and Ship Use

By C. T. PAYN and W. ARVON WALES, B.Sc. (Eng.), M.I.E.E.

A facility that is becoming increasingly popular is two-way local speech communication between shore-based executives of a port or harbour and the tugs, launches and other craft in the vicinity.

This system of communication which is effected by the use of equipment designed to operate on very high frequency radio waves is termed V.H.F. communication.

Its inception took place during the last war with the advent of the Service Walkie-Talkie, which was adapted for local ship control. Such equipment was used by the Port of Liverpool and now it has grown from this small beginning into a complete radio telephone service.

To avoid undue confusion and ensure coherent control, the International Radio Conference, held in Atlantic City in 1947, allocated certain frequency bands within the V.H.F. range for communication services of the type referred to above. In this country, control of the assignment of frequencies within these bands to individual users is exercised by the General Post Office, which also assists in co-ordinating Colonial requirements. The self-governing members of the Commonwealth control their own radio destinies, but maintain liaison amongst themselves and the United Kingdom.

The adoption of International Regulations also leads to the standardisation of equipment with the advantage, that manufacturing costs can be reduced and equipment purchased in other countries can be interchangeable.

In this way the design and operation of schemes are regulated and they fall into an International pattern. The control also ensures that there is no infringement of frequency bands allocated to other radio services, such as, for example, those devoted to aeronautical radio navigation or broadcasting.

Some of the main features of V.H.F. radio communication now under discussion are :

(1) Limited range of operation; the best results are obtained when the speech distance does not exceed the line of sight.
(2) Good speech transmission and reception, due to comparative freedom of V.H.F. communication from interference from man-made noise.
(3) Small bulk of mobile and portable units, usually the mobile set is a permanent fixture whereas the portable unit is carried by the user.
(4) The fixed (control station) equipment is compact and requires no more space than a small private telephone switchboard.

On the question of coverage, other things being equal, the best results will be obtained if the fixed, or shore, station and its aerial are located as high as possible, with a minimum of screening from high ground or buildings between the aerial and the mobile unit. Where it is not possible, or convenient, to have the fixed station adjacent to the aerial, one of the following three methods may be used:

(a) If the distance does not exceed 100 feet, it is possible to use a suitable cable without undue loss of efficiency.
(b) If the distance exceeds 100 feet but is under 300 feet, it is usually possible to control the switching and audio circuits of the transmitter and receiver by extending them into the station.
(c) If, however, the separation is much greater, up to 5 or 6 miles, the transmitter and receiver may be located adjacent to the aerial, their operation being remotely controlled over a pair of telephone lines between the fixed station and the transmitter/receiver location.

Mobile stations fall into two categories:

(a) Those permanently installed in a vessel.
(b) Hand portable sets or Walkie-Talkies for occasional use.

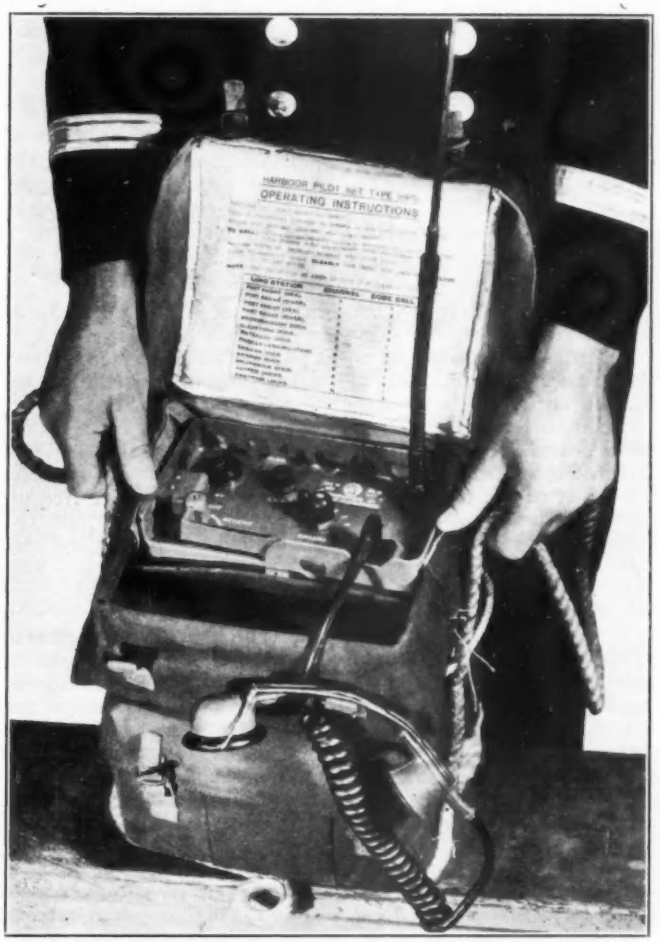
Permanently installed mobile stations present no difficulty and, apart from power supplies, the apparatus seldom differs from that used at the fixed station. Ships' batteries, can afford the mobile station power supply, whilst mains supply is normally available at the fixed station.

Hand portable sets, such as those carried by pilots of the Mersey Docks and Harbour Board when boarding vessels they are taking over, are a different proposition. Here weight and dimensions are of primary importance and the performance is dependent largely upon the limited amount of equipment that can be carried in addition to the batteries necessary to work it.

The systems available for V.H.F. communication are :

(1) Simplex working using single-frequency channel.
(2) Simplex using a two-frequency channel.
(3) Duplex working using a two-frequency channel.

The first is the simplest of the three systems, and direct intercommunication between any or all the mobile stations and the fixed station is possible. It has the disadvantage, however, that all stations can speak at once and there is no over-riding control of the facility.



A Six-channel portable set used by Ships' Pilots of the Mersey Docks and Harbour Board, at the Port of Liverpool to communicate with the main Radar Station and any one of nine Dock Stations.

With systems (1) and (2) the receiver is switched off when the transmitter is on, and vice-versa; that is to say, working is on an "over to you" basis. This results in a saving in electrical power, and the batteries may, therefore, be smaller and lighter in weight.

System (3) provides a service similar to that given by the ordinary line telephone. In this case the transmitters and receivers are energised continuously while there is any possibility of a message being sent out or received. This system of working is necessary if, as in the case of the Thames Radio Service, connection is made with the public telephone network, and it is an advantage in that no operating skill is required.

Radio Speech Communication—continued

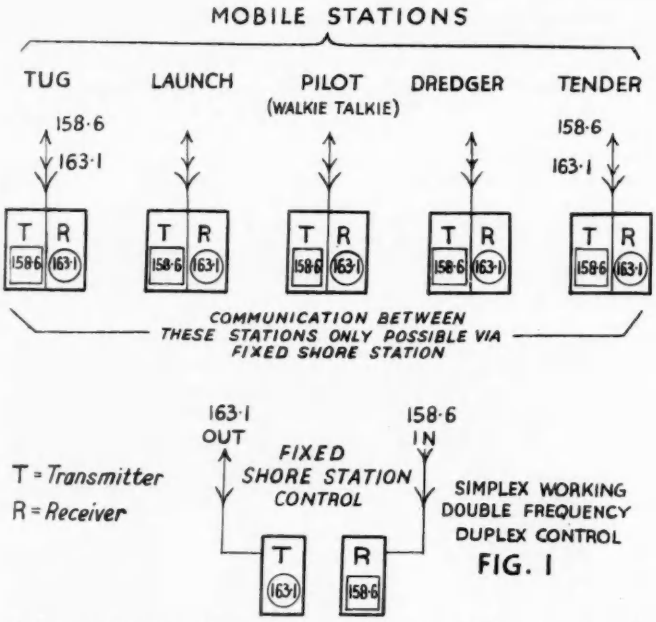


FIG. 1

There is little to choose between the cost of the apparatus for systems (1) and (2) but that for (3) is more expensive.

A satisfactory scheme that might be simply inplemented is shown by the diagrams (Fig. I and II) which illustrate a Simplex system working on double frequency (2).

Here two channels, one for transmitting and one for receiving, are allocated. One is for transmitting from the fixed station to any mobile station receiver, the second for transmitting from any mobile set to the fixed station receiver. The two high freqency channels are separated by 4.5 megacycles, in order to eliminate inteference. This degree of separation applies to marine use only.

In operation, there is only one pair of subscribers at a time, thus full control is ensured, but the rest have to wait. For extreme urgency, arrangements can be devised, to give priority or to limit the duration of the calls. The limit of the number of subscribers using the one pair of channels will depend on the facilities required. In highly organised groups, such as a police area, the whole area may work on one pair, which means that conversations are brisk and talking reduced to a minimum. It also applies to ambulance work where in one area there are about 50 mobile stations operating from the one fixed station. The potential user is there but the maximum loading per channel would vary with individual cases according to traffic and terrain. Another service that is rapidly developing, is the London " Radio Cab " service. This will ultimately have 500 taxi-cabs equipped with this gear, and the authors can vouch for its effectiveness by a call for a taxi from a local telephone call box which received prompt response.

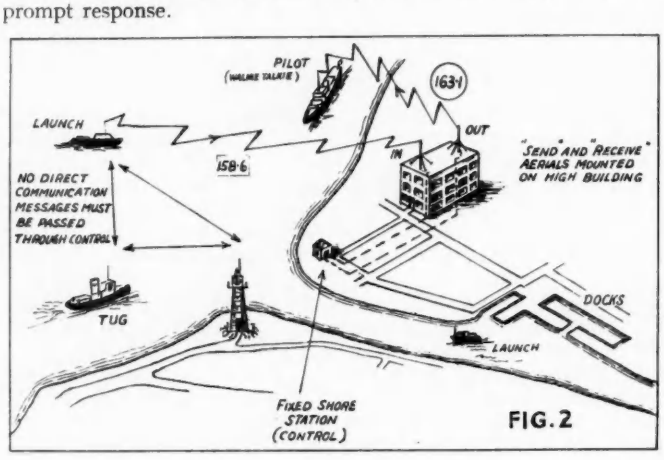


FIG. 2

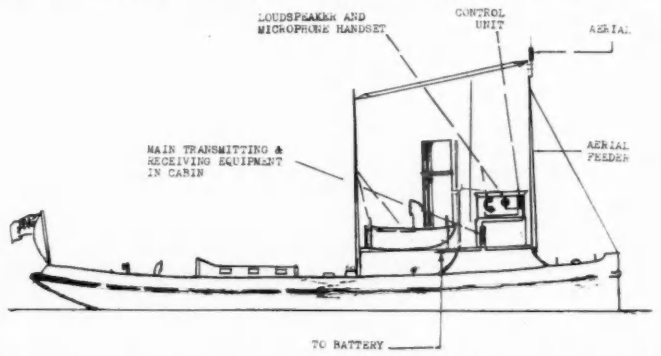
In considering the cost of the equipment there is always a very strong desire to accept the cheapest in first cost. This usually turns out to be the dearest in the long run.

Taking efficiency, maintenance and replacement into account, it is found that when all factors have been weighed up, one of the more expensive types meets the case. For effective communication, the Post Office Engineering Department have drawn up specifications with the object of ensuring that V.H.F. apparatus conforms to a suitable standard of performance and does not set up interference to others using the same, or adjacent frequencies.

Some typical costs for local communication equipment are for a 10 watt set with, say an effective coverage of 20 miles, about £200, while for a 3 watt set with half the coverage the price is round about £170. A Walki-Talkie set costs in the neighbourhood of £90. These figures of range are perhaps on the conversative side but represent averages on yearly conditions.

Maintenance for fixed and mobile sets can be facilitated by ensuring that the transmitter and receiver are built on the unit system. This system was devised under war conditions for replacing a faulty section with little loss of time. The sections which form the unit are in the shape of a set of drawers which can be slipped out and replaced by a standby of the appropriate components. Test points are an added advantage and should be incorporated in the set.

The frequency band allocated to " ship-to-shore " communication is 156-165 megacycles. In this band 156.8 megacycles has been agreed internationally for safety calling, intership and harbour control communication. In addition, there is a measure of



informal agreement to the standardisation of frequency channels for the public correspondence service and certain blocks of frequencies have been set aside for national two-frequency public correspondence channels and for the use of Harbour, Docking and Pilotage Authorities.

For Great Britain and the Colonies, a frequency assignment and a licence to operate must be obtained from the Post Office, and for practical reasons, it is obvious that the frequency assignment must be obtained before ordering the equipment.

Amplitude modulation (A.M.) which has been adopted in this country for the service mentioned above, has also been taken up by a number of other countries. In the U.S.A., merchant ships use what is called frequency modulation (F.M.) for V.H.F. communciation. A.M. and F.M. are different methods of adapting the high frequency radio waves to carry intelligence in the ether There is, therefore, an international complication over the use of these two methods of modulation and in the new hemisphere matters are further complicated as a considerable number of U.S.A. naval ships are equipped with A.M.

To recapitulate, the essential features are, communication over the visual range, standardisation and a central control. Finally, one must get rid of the idea that by putting a Walkie-Talkie into a boat all will be well. These sets must be used sparingly as their day has yet to come. To stop undue " nattering " the use of the local ether has to be controlled by a master station. In biblical days the problem at the tower of Babel was to prevent its further construction and this was effected by the allocation of different languages. This is somewhat analogous to the confusion that would arise, if no control was exercised over the use of V.H.F. as a means of communication.

Ports of India and Pakistan

Reports issued of Recent Surveys

The Report of the Ports Technical Committee which was issued early in 1946, before British India was given independence and divided into the two Dominions of India and Pakistan, contained many recommendations concerning future port development, and full details of the proposals were published in the July 1947 and two following issues of this Journal. Owing to the political changes, however, it was not found possible to implement the recommendations contained in the original Report, and subsequently, each Dominion made an independent review of their port facilities and have since issued separate reports of their proposals concerning future plans.

SURVEY OF PAKISTAN PORTS

Details of some of the short-term and long-term port development and improvement plans authorised by the Pakistan Government following an economic survey of the country are as follows:

Port of Chittagong.

Pointing to the strain placed on Chittagong after Partition, the survey states that a small port which had previously been entirely subsidiary to Calcutta, and only capable of handling three ships 500-ft. in length at a time and with a capacity of between 500,000 and 600,000 tons of cargo per annum, became the main, and indeed the only port for East Bengal's imports and exports, most of which had previously passed through the Port of Calcutta.

With equipment that was old and in comparatively poor condition, the port was obviously inadequate for its new role. The Pakistan Government has therefore approved an immediate short-term programme which provides for :—

The extension of berth No. 4 by 330-ft. to provide a berth for one ship; the extension of berth No. 1 by 60-ft. to provide berthage for bigger ships; the construction of a jetty at Salt Golas; the extension of transit shed No. 4; the reconstruction of storage shed "A"; the rebuilding of the marshalling yard; the provision of a river lighting scheme for night pilotage of ships during fair weather; and the provision of additional sets of moorings for midstream loading and unloading of cargo.

In addition, long-term development plans which should enable the port to handle about three million tons of cargo per annum have been drawn up by the consulting engineers to the Pakistan Government. These plans, which involve an expenditure of Rs.15 crores (about £16.25 million); provide for an 18-berth port, and include the following proposals :—

Construction of eight new cargo berths and of one passenger ship berth; reconstruction of four existing berths; construction of two salt golas, four lighterage jetties, ten transit sheds, ten warehouses, and ten export sheds; installation of dockside cranes, wharfage and haulage equipment; and development of railway yards, marshalling sidings, storage sites, roads, bridges, a port colony, lighting, power, water and other services.

Much has already been done, the survey continues, to increase the flow of goods through the port by improving the supply of wagons, increasing shed facilities, and providing additional berths and moorings. By the middle of last year the port was handling something like 150,000 tons per month. Chittagong is particularly important for jute, and special efforts have been made to expand this export.

Port of Karachi.

With regard to Pakistan's other major port, Karachi, the survey points out that although the volume of traffic since Partition has increased greatly, the port, which has 21 berths and 18 sets of moorings, is capable of handling 12,000 tons of cargo per day. It has had no difficulty in dealing with this volume of goods and indeed should be able to cope with all the traffic likely to develop over the next few years.

Although there are no dry-docking facilities, no immediate major improvements in the port's facilities are planned. A scheme has been prepared for the reconstruction of the east wharf (which is at present timber decked), the improvement of the rail layout and of roads, and transit sheds at berths, and the installation of new and larger cranes. These improvements, if carried out, would increase the capacity of the port by between 35 and 50 per cent.

Shipping Developments.

Dealing with shipping, the survey notes that before Partition the only shipping company with its headquarters in which is now Pakistan was the Karachi Steam Navigation Company, founded in January, 1947. Since Partition, Karachi and Chittagong have botn been declared ports of registry by order of the Governor-General under the Merchant Shipping Act of 1894.

Four new shipping companies have been formed, the Muhammandi Steamship Company, the East and West Steamship Company, the Trans-Oceanic Steamship Company, and the Pan-Islamic Steamship Co., Ltd. These companies have built up a fleet of Pakistan-owned shipping by purchasing old ships and converting ex-naval trawlers. It is stated that this fleet amounted in May last year to between 60,000 and 70,000 tons. The first two companies have also gone in for time chartering on a considerable scale.

DEVELOPMENT OF MINOR PORTS IN INDIA

When the National Harbour Board of India met in New Delhi, for the first time in August 1950, it suggested to the Indian Government that a survey of the minor ports of the county should be undertaken and recommendations put forward on how to improve them. The Ministry of Transport accordingly appointed a Minor Ports Committee under the chairmanship of Mr. S. Nanjundiah, Administrative Officer, Vizagapatam Port, to carry out the work, and their Report was published towards the end of last year.

Following the publication of the Report, the proposals were discussed by the National Harbour Board in Bombay, and after considering ways and means of financing the suggested improvements, estimated to cost Rs 25 million, the Board recommended that half of the cost should be met by State Governments, and part of the balance should be found by the Government of India and the remainder by a small port wharfage charge. It was also agreed that the State Governments should be asked to examine the Report in detail, and make known their views to the Indian Government before January 31, 1952.

The Report, which is the first of its kind to be carried out after the political and financial integration of the former Indian States, stresses the urgency of the problem of dredging in the minor ports and indicates that the financial position of most of them is unsound.

Classification of Ports.

The minor ports in India present an amazing variety in size and functions, the volume of traffic handled, financial position, and administrative set up. The facilities provided vary from nothing in some of the open roadstead ports on the sea board to five elaborate harbours with dredgers and equipment as in Saurashtra; from ports handling only a few hundred tons per year to as much as 500,000 tons per year; from ports with an income of only a few hundred rupees per year to those with an income range of Rs 6 to 8 lakhs per year.

Therefore, apart from major ports, which are under the Union Government, Mr. Nunjundiah considers a further sub-classification of ports coming under the category of minor ports, which are under the administrative control of State Governments, as necessary. Ports which handle or have handled in the past 100,000 tons or more of cargo per year or are otherwise important may be classed as intermediate ports. Other ports, with an annual cargo tonnage below 100,000 tons but not less than 1,500 tons, or which have an importance for any other reason such as passenger amenity, customs or naval requirements, may be classed as minor ports. All the remaining ports may be classed as sub-ports or petty ports.

With a few exceptions, practically all the minor ports are roadsteads, and cargo has to be carried in lighter or country-boats from ship to shore and vice versa.

Mr. Nanjundiah has recommended that some of them, like Chandbali, Kakinada, Tuticorin and Beypore could, at no great capital outlay, be converted into medium-sized ports capable of taking coastal ships drawing 15 to 18-ft. (3,000 tons).

The main works involved will be construction or alteration of suitable berths or jetties and measures necessary for maintaining the depths at a proper level. He, however, expresses the view that any such development should be preceded by a decision re-

Ports of India and Pakistan—continued

garding the size of future coastal ships. At present ships of small tonnage (under 4,000 tons) are in regular use only on the West Coast. If such ships are put on the East Coast trade also, there will be a great stimulus to coastal trade.

If only large-sized ships drawing over 20-ft. are used, there would be no necessity or advantage in dredging or maintaining depths at more than 8 feet below low water.

Hydrographic Surveys.

The report suggests that, before any scheme of expansion of a port is undertaken, it is necessary that a hydrographic survey of the approaches to the port and in some cases the anchorages should be carried out. Many of the gulfs, creeks and river mouths have also to be surved systematically, not only for the use of the river or creek ports wherever such exist but also for river conservancy and conservation of the coastline and in some cases with a view to examining the possibility of opening up inland waters for navigational purposes.

In order to be able to carry out hydrographic surveys within a reasonable time, the Marine Survey Wing of the Ministry of Defence will have to be trebled. It is suggested that the costs of the initial survey and of any steps essential for conservation of the coast should be the responsibility either of the Union Government or of the State Government concerned or both in agreed proportion and not of the ports either individually or collectively. Each port should however, carry out, at its own cost, periodical surveys of the quiet waters of the inner harbour.

Dredging Problem.

The problem of dredging which is urgent in most of the ports, varies from a simple operation of removing a few thousand tons of sand per year in comparatively calm waters to complicated and large-scale operations as at Bhavnagar. For the size of India's coastline and the number of major and minor ports concerned, the report suggests that additional equipment should be provided and that two pools of dredgers, one at Madras and the other in Saurashtra, should be created for the needy minor ports to draw upon. The need for the replacement of old and obsolete dredgers is also stressed.

Maintenance of Sailing Vessels.

As approximately 40 per cent. of the trade of minor ports is carried by sailing vessels, every facility should be given for their upkeep, maintenance and repair and laying-up during non-working seasons at as many ports as possible. In particular, the ports of Kakinada, Cuddalore, Tuticorin, Beypore, Mangalore, Karwar, Bhavnagar, Verawal, Bedi, Navalakhi, Okha and Mandvi should take action to provide such facilities. The boat-building industry established for decades in Tuticorin and Mandvi is languishing and should be revived and encouraged.

Port Administration.

The report makes certain suggestions for improving the administration of minor ports within the framework of the present system of administration by the State Governments. A proposal made in certain quarters that the Central Government should take over all the minor ports under its direct administrative control is not recommended because the difficulties will be many and there will be no financial or other advantages. Whatever the practice in certain other countries may be, the extension of the system of railway management of ports is also not recommended.

The formation of a Port Trust at Tuticorin under the aegis of the State Government has been a great success, but the extension of this system to other places is not considered practicable or advantageous at present, except in the case of Mangalore. The establishment of a Port Trust for Mangalore on the lines of the Tuticorin Port Trust is favoured by Mr. Nanjundiah who has proposed to the Madras State to take up the necessary legislation with the concurrence of the Central Government.

The report proposes the formation of a Port Fund as soon as possible to cover all the ports of Travancore-Cochin State, the Alleppey Landing and Shipping Fees Fund however continuing to function at Alleppey as a separate entity. It also stresses that Okha should be kept going at its present level of utility and without loss of existing capacity.

Need for Central Port Organisation.

There is a need for a Central port organisation under the Ministry of Transport for purposes of co-ordination, exchange of information, technical personnel and plant and craft, and avoidance of duplication, wasteful competition and uneconomic constructions. This organisation should be under a Director, who should be an engineer with experience of ports and harbour constructions.

The report urges the administrative authorities in charge of ports to compile and maintain complete statistics of the trade, shipping and finances of the important ports and submit their returns to the Transport Ministry. The Ministry may lay down a list of returns, including budgets, annual accounts and administrative reports, to be sent by the States in respect of some or all of the minor ports in each State.

The report reveals a large diversity in port dues and charges levied from port to port—varying from nine pies to nine annas per ton. Though it may not be possible, nor necessary, to bring about a rigid uniformity in rates throughout India, the present wide variation, which in the past was due to competition and to differences in administrative conditions in the country, may be narrowed down.

The other recommendations made are:

(a) Introduction of a proper accounting system on a more or less uniform basis for all the States;
(b) Maintenance of capital and depreciation reserve fund accounts separately from revenue accounts of port and pilotage funds;
(c) Improvement of finances of Bombay, Okha and Saurashtra ports by enhancing the levying of wharfage fees, and discontinuance of port development levy at Saurashtra by suitably raising the charges on cargo;
(d) Creation of a pool of tugs and purchase of additional tugs and launches.

Precarious Financial Position.

The survey revealed that the financial position of minor ports was by no means sound, the trend being for expenditure to exceed receipts: Tuticorin is an exception, but Travancore and Cutch ports have been a drain on the State's finances.

The States of Orissa, Madras and Bombay are drawing upon their reserves annually, and at the present rate there will be no balances in 3 or 4 years' time unless trade improves. No surplus is available in the various port funds for undertaking capital development works.

To provide finances for improving minor ports the report suggests the making of free grants by the States concerned or the grant of interest free loans repayable from revenue surplusses of future years. Having regard to the important role that these ports played in the transport system of the country, they can lay claim to such State assistance.

It has been suggested that the total expenditure of nearly Rs. 2.5 crores (twenty-five million rupees) inclusive of the cost of dredges and tugs, may be shared by the States as follows :—

Madras, Rs. 100 lakhs (ten million rupees).
Bombay (excluding Okha) Rs. 25 lakhs.
Saurashtra (excluding Bhavanagar) Rs. 37 lakhs.
Travancore-Cochin, Rs. 15 lakhs.
Cutch, Rs. 25 lakhs.
Orissa, Rs. 10 lakhs.
Tuticorin, Rs. 18 and Okha, Rs. 20 lakhs.

The proposals cover only those improvements which are absolutely essential to maintain the ports at their present level of efficiency and capacity.

Improvements to Cyprus Ports.

A report has been received from Nicosia that the ports of Limassol and Famagusta in Cyprus, congested with the expanding export trade and the increased British military traffic, are to be developed and improved this year.

Port Economics

Part 2. The Characteristics and Functions of Ports

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General Manager and Clerk, River Wear Commissioners, and General Manager, Sunderland Corporation Quay.

According to the strict meaning of the word, a port is a gateway and, in general modern usage, we employ the word port to mean seaport and sometimes river port or canal port—that is, a gateway between land and water. One side of the gateway is used by ships, small craft and flying-boats: the other side by railway trains and motor lorries: and through every such gateway there constantly passes some part of the traffic of the world—that is, goods or passengers or both. It is, indeed, the fundamental characteristic of a port that it should be able to accommodate ships on the one hand and land transport vehicles on the other: and that is why every port is equipped to look two ways—outwards over the sea or the waterway and inwards over its economic hinterland. In one respect the analogy of the gateway becomes somewhat strained—namely in the case of coastwise vessels and inland waterway carriers receiving cargo direct from ocean-going ships. When so engaged, the smaller vessel is supplying an on-carrying and distributive service of the same functional character as the railway train or the road vehicle: but, at the same time, it is as much a ship as the liner or deep-sea tramp which it serves: and it functions on the same side—the seaward side—of the ports or sea gateways of the world. In such cases, the traffic does not pass *through* the gateway but is transferred, as it were, *at* the gateway itself. But at its discharging port, the coaster delivering imported cargo becomes wholly a ship and must be accommodated accordingly. This dual character of the coastwise vessel is of great importance in world transport: for the coastwise owner is, on the one hand, intensely interested in the activities of rail and road carriers: and, on the other, he is also deeply involved in all that concerns ships. In these respects, his outlook is somewhat similar to that of port authorities although the economic basis of his activities is usually different.

A port, then, is a gateway, but it must be many other things as well. Perhaps most important of all, it must be a haven—that is, a protected area where ships may safely berth, in sufficient water and guarded from the dangers of the sea and bad weather. Not all havens are ports, but every efficient port must be a haven. The necessary amount of quiet accommodation may be provided by nature as in a landlocked bay with deep water, an unexposed sea entrance and some high ground warding off the prevailing wind. Or it may be that all these conditions, or as many as possible, have had to be provided by the harbour engineer—breakwaters and piers to produce quiet water, and rock dredging to give the requisite depth in the entrance channel, the approach channels and the berths. Other man-made safety provisions are lighthouses, fog signals, shore-based radar and wireless telephony, pilotage services, towage facilities, and buoys and beacons to mark dredged channels and underwater perils. Safe entrance and good shelter for shipping are such essential characteristics of a seaport that without them there can be no seaport at all.

But these are only the beginnings of the functions of a port—and, indeed, as has been said, their basic essentials may be completely provided by nature as in the celebrated case of Milford Haven which is an inlet of the sea and a river estuary on the south-west coast of Pembrokeshire, 12 miles long with a width varying from three-quarters to one-mile-and-three-quarters. In addition to a safe approach and a peaceful anchorage, the modern seaport provides the whole range of services and the various kinds of accommodation which are commonly grouped under the heading of terminal facilities for ships, passengers and cargoes.

A ship is a carrier, and when she is not carrying—that is, moving across the sea with freight—she at once begins to lose money for her owner at a prodigious rate. In this connection, it is worthy of note by port economists that one famous Company of British owners, trading between Australia and the United Kingdom, is able to accomplish only two trips each year by each of its many ships: the one-way time at sea is 31 days—in other words, the vessel spends four months of the year crossing the ocean and eight months on the coasts of the United Kingdom and Australia. It is believed that this example is not a rarity: and it is understandable, therefore, that the lay-out, facilities and equipment of an up-to-date seaport are designed (and, where necessary, should be increasingly adapted) for the swift turnround of ships.

A seaport may be a cargo port or a passenger port or both. In the last case, its reputation may rest more firmly on one class of trade than upon the other. Southampton is a famous passenger port—but it also has an important cargo trade. Liverpool is one of the greatest cargo ports in the world—but its passenger traffic is considerable. London is the greatest of all ports and possesses extensive facilities for both passengers and goods.

In order to discharge its function as a gateway for import and export cargoes, a port must possess and maintain good quays alongside which the vessel may safely lie: the quays should be well-surfaced, adequately drained and lighted, equipped with railway lines—flush with the surface—and with bollards and capstans. Where, owing to a great rise and fall of tide, there is an insufficiency of deep water at minimum periods, the quays must be located in docks where water can be impounded. They must be furnished with sufficient cranes of suitable height, radius and capacity, and provided with transit sheds and/or warehouses. There must exist a sufficient labour force of dock workers, and a stevedoring organisation, provided either by the port authority or by private firms, and possessing all requisite types of cargo-handling gear. No quay in the United Kingdom can operate as a reception point for goods from foreign countries unless it is so " privileged " by H.M. Customs and Excise and it is the duty of the quay owner to provide office accommodation for the Customs officers.

The function of providing skilled pilots is sometimes part of the duty of the port authority: in other cases the pilots work under an independent regulating body. Again, the port authority may itself do some of the stevedoring as at Bristol and Sunderland: or all of it, as at Manchester: or none of it, as at Liverpool. At some ports, the port authority provides some or all of the tugs: at other ports, towage is left entirely to private enterprise. In addition to pilots and tugs, incoming and departing vessels normally require the services of boatmen to take lines and handle ropes on and off mooring buoys or quay bollards: and this is another service—usually regulated but not supplied by the port authority—which must be available at a seaport.

In connection with the handling of goods, many ports perform a series of functions which travel far beyond the bare idea conveyed by the word " gateway." Sooner or later, it is true, all goods which arrive at a port may be said to pass " through " it. But millions of tons of assorted merchandise are being held at the world's ports at any given moment. And this is not simply a matter of warehousing—for, in many cases, goods are not merely stored at ports but are manipulated in numerous different ways. The most common aspect of this branch of port activity is bulk importation, storage at the port over a period of months, and gradual sub-division and forwarding in hundreds of small consignments. This service of holding the bulk import in dock warehouses, and gradually breaking it down and distributing the goods in small lots, is an important commercial function performed by ports which is frequently overlooked.

The reverse service is required by exporters and, here again, the port is the focal point. There are normally many more exporters than there are ships or shipping opportunities. The port receives the goods from far and near—and they arrive by rail or road or

Port Economics—continued

canal boat or coastwise steamer. The port lands and stores the goods and places them, alongside the berth if possible, under cover or in the open, and in such an arrangement as will be most suitable for the rapid and safe loading of the export vessel as soon as she arrives.

Also, it is at the ports of the world that sea-borne goods are sampled, weighed, tested, measured and rated for Customs duty. It is whilst lying in dock warehouses that a large proportion of goods brought from overseas are bought and sold. In many trades, regular auctions and sales are held at ports. It is to discharge these functions that ports are provided with warehouses and cold stores, granaries and petroleum installations, timber yards, bonded stores and auction rooms. The bonded warehouse is a particularly important facility for it enables the importer to store dutiable goods and to put off the outlay of money in taxes until he wants the goods himself or has found a customer for them, thus leaving him in the meantime with larger financial resources for further commercial enterprise. This is an excellent example of the ideal economic requirement of making all available money and credit do its full share of work all the time.

The governing body of a port often functions as a private railway company. Within the limits of the port estate, it lays down and maintains track and owns and operates locomotives and wagons for internal user. In such cases, the port's engines take over loaded and empty trains at exchange sidings and hand over outgoing trains in the same way. Where the port authority has no railway organisation of its own, the railway services right up to the berths, warehouses and storage grounds are supplied by national or other railways.

Ports having regular passenger traffic normally provide special quays or landing stages laid out for Customs requirements and baggage handling, and equipped with restaurants and rest rooms, arrangements for immigration formalities, port health routine, facilities for motor vehicle traffic and for the shipping and unshipping of motor cars. At the rear of the quayside buildings are the sidings for the reception and despatch of passenger trains. The magnificent new ocean terminal at Southampton is the most modern example of this type of layout.

Conservancy duties frequently form part of the functions of a port authority. Essentially, conservancy means taking care of a river—and requiring other persons to do their lawful share towards that desirable end. Dredging, the preservation of banks and the suppression of nuisances are the chief tasks. An upstream point is commonly laid down in the authority's private Act of Parliament as the limit of the authority's jurisdiction: and seaward boundaries are similarly fixed.

The existence of ports promotes or assists the discharge of a number of other commercial, industrial, social and Governmental functions. The governing bodies of the ports of the world very commonly finance their capital developments by public borrowings on fixed interest securities and a large field of investment has thus been created which has ranked high in general esteem for many years past. Again, in their capacity as the route terminals of international traffic, the ports provide the obvious places for immigration control, currency regulation as between one country and others, port health control (including the inspection of ships and of incoming foodstuffs) and many of the tasks of H.M. Customs.

Ports do more for ships than receiving them and berthing them safely, discharging them, loading them and getting them away again to sea. For, were it not for the existence and development of certain seaports, no ship would ever be born at all—since the industry of shipbuilding can only exist at a well-appointed port, particularly in our own generation during which the size of ships has grown ever greater. In years gone by, some ships were built at Sunderland, for example, on open ground away back from the River Wear, and when ready for launching, were run on skids down the intervening streets into the river. But to-day, Sunderland yards turn out tankers as large as 23,000 tons capacity, and, in consequence, the yards themselves have become imposing riverside or dockside establishments, and the port has had to enlarge its own facilities to cope with these great modern vessels. Similarly, ports and rivers such as the Clyde, Belfast, the Tyne and Gothenburg—to name but a few— are the birthplaces of many fine new ships, and it is only at such places that the construction, launching and fitting out of modern vessels is possible. With shipbuilding goes marine engine building, and it is understandable that the great marine engine works of the world are most often found at the great seaports—usually, indeed, with their own engine-shipping quays, so that only the quay itself lies between the newly-launched hull and the works where her engines are built.

The allied business of ship-repairing is manifestly another service which must be provided at the ports and with this goes dry-docking facilities for ships that may require them—either for repairs or for periodical underwater survey. Drydocks are sometimes owned and operated by port authorities and sometimes by ship-repairing firms, but, whoever provides them, they are essential requirements at all seaports of importance.

Ships must have regular supplies of fuel and a great variety of other stores for the service of the ship herself and to satisfy the wants of the crew and the passengers. Bunkering, watering, storing and victualling are therefore functions which must be discharged by seaports. Of these, the port authority is commonly (but not always) concerned with the provision and maintenance of bunkering berths and bunkering appliances, and with the delivery of fresh water by shore hydrants or waterboats. The supplies of fuel oil, diesel oil or coal are obtained and sent forward to the port by bunkering agents in contract with the shipowner or his local agent. All other requirements are sold and delivered to the ship by ship's stores merchants—and the variety of such supplies is very great, including rope, cordage, wires, lubricating oil, galley coal, chains, meat, provisions, working clothes and a hundred other articles.

Again, the governing body of a port is usually the owner of the land within the limits of the port estate. Because of this, one of the normal functions of a port authority is to act as a ground landlord, but with a special aim always in view. That aim is the better development of its seaport and an ever-higher standard of service to the shipping and mercantile community generally, and particularly to those who live and work in the seaport itself and in the hinterland which it especially serves. Therefore the authority does not lease land to everybody who may ask for it: but, when it has land to spare, or when land has been newly-won from the sea, it is always ready to lease appropriate areas to persons or firms who will contribute something new to the volume or the character of the port's business and who will, in turn, themselves reap some special advantage from a location on the port estate. It is for these reasons that among the tenancies on port estates are commonly found timber yards, sawmills, pitwood yards, petroleum installations, granaries, flour mills, shipyards, marine engine works, warehouses, bonded stores, cold stores and a great variety of other trades, every one having something to contribute to the life and business of the port.

Reference has been made above to the hinterland of a seaport and it may be well to discuss this concept in some detail. There is a basic notion in the theory of a port's hinterland, but, in practice, the basic notion becomes modified in various ways. The basic notion is that a given seaport should attract to itself, from across the sea, all the import traffic destined for points within a certain area about itself, and also all the export traffic arising within that same approximate area. The basic notion pre-supposes that every inland town, factory, market and warehouse will be in transport communication with one particular seaport which, being the nearest, will be cheaper to use than any other. If this were always true, and if there were no modifying factors, the port hinterlands of the world could be drawn upon the map with great accuracy. The facts are, however, that transport facilities to the nearest port are not always adequate, are not always the most suitable and are not always cheaper than others. Moreover, the flow of traffic between inland points and the seaports is always being affected by one or more of the following considerations :—

(1) **The value of ship's time.** The undue proportion of time-on-the-coast to time-at-sea has already been mentioned. Ideally, the shipowner would like one port only at home and one port only overseas. But, in many cases, he found out long ago that he could not fill his ship that way. So he often calls at two, three or more ports in the loading country and again in the discharging

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country. But he is always striving to keep the number down in order to avoid additional port charges and—more important still—to give his ship the highest possible proportion of freight-earning running time. On the other hand, the receivers and senders of cargo are constantly pressing the shipowner to come to their nearest port, and the governing body of the local port adds to this pressure and offers such inducements as it can. In this matter, shipowners will sometimes do more than they otherwise might if they need cargo badly and if a rival shipowner is likely to get it if they do not. This tendency, however, is somewhat checked by the existence of liner conferences, by which, in effect, shipowners seek to divide up the world-carrying trade by agreement and by refraining from poaching. But even when a port fails to secure a regular call by an ocean-going liner, the theory of the natural hinterland often still holds good, in a more limited way, inasmuch as a coastwise steamer may be put in to pick up or deliver the local cargo thus acting as a tender and time-saver for the larger vessel remaining at her berth-port some miles away.

(2) **Port capacity and port facilities.** At a given inland point, manufacturers may require raw materials from overseas which are regularly carried in large ships too big to be accommodated at the nearest seaport. The same difficulty may apply to export cargo arising in the natural hinterland of a particular port. Again, the nearest port may be out of favour because it has insufficient working berths, thus involving ships in waiting time which they are not prepared to face. Special cargoes often require special handling or storage facilities—imported refrigerated produce, for instance, must go into cold stores, in whole or in part, and liners wishing to discharge frozen meat and similar cargo must therefore go to ports with cold stores. And again, heavy indivisible lifts for export must go to ports having heavy lifting machinery of sufficient capacity, or to a port where a suitable vessel with heavy lifting gear is able and ready to call.

(3) **The influence of markets.** The great established markets in particular commodities are not always to be found where the goods are used: or the goods may be used at many different places whilst the marketing centres may be few—sometimes only one important one for a whole country, with provincial subsidiary markets. The great markets for imported goods tend to centre themselves at a few great ports: and the inward-bound liner tends to discharge her cargo at the market-port rather than at some other port which might be nearer the actual areas of consumption. The attraction of the market-port is that the importers and potential buyers are established there: expert samplers and surveyors are at hand: documents affecting the ship and her cargo are conveniently and expeditiously handled: arrangements for inspection and for sales can be swiftly made: and the banks established there are accustomed to implementing transactions (often of a large order) associated with such cargoes. London, for example, undoubtedly owes much of its greatness as a port to the wealth, influence and enterprise of its merchants and bankers and to its position as a world market for many important articles of overseas trade. Nevertheless, in our generation, there has been some degree of movement away from the concentration of shipping upon a few great market-ports, and some tendency towards decentralisation.

(4) **Two-way trade.** An inward vessel, bringing the raw materials of manufacture, will sometimes discharge at a port which is not the nearest to the inland point where the materials are required, because her owner knows that at the port of his choice he can pick up an outward cargo.

(5) **Established bases.** The ships of the world are commonly owned and operated in fleets and, in consequence, the owning Company finds it convenient to establish one or more shore bases, often of an elaborate kind. Arrangements at the shore base frequently include a marine superintendent's department responsible for the care of the ships themselves: this department will look after repairs, renewals, supply of spare parts, surveys, dry-dockings and all such matters. Again, at the fleet's shore base, the owners may have a cargo superintendent's department. Generally speaking, it is the ship's duty to discharge inward cargo, that is, lift it as far as the rail of the vessel, and the cargo superintendent may have a complete stevedoring organisation to perform this work: similarly the ship must receive outward cargo at the rail and stow it in the vessel. Whether the cargo superintendent carries out these duties departmentally, or whether he lets them out to contractors, he will be responsible for them and for many other tasks connected with the care of the cargo.

Owners only set up such organisations at ports where they most frequently call and, having set them up and developed them, it is understandable that they are generally reluctant to send their vessels to ports where they cannot look after them themselves.

(6) **The paying load and the cargo nucleus.** A cargo vessel, whether liner or tramp, will try to limit her visits to a few ports where sufficient cargo is regularly wanted or can be picked up to make each voyage a financial success. Having thus established the steady prospect of a regular cargo nucleus, the owner will be prepared to take other cargo, for or from more distant points, up to the limit of his ship's capacity: but it may not be worth his while to visit other ports to deliver or to load such additional cargo which may therefore have to be transported considerable distances overland or by a coastwise vessel. In such cases the greater amount of cargo is dealt with in accordance with the hinterland theory: but the lesser amounts are directed away from their respective nearest ports.

(7) **Repairs and dry-docking.** The existence of reputable repairing firms and especially of adequate drydocks at particular ports and not at others is occasionally one of the factors which influence the flow of cargo away from its nearest port to some other port. A ship requiring survey or repairs will take a cargo to the repairing port if she can: and, when she is ready for sea again, it is obviously good business for her owner, if she can pick up cargo at the repairing port and start straight away to earn freight. Cargo may therefore pass through a port so equipped instead of through its nearest port.

(8) **Agreed railway charges.** One of the underlying ideas which support the hinterland theory is that it always costs more to send a given ton of goods 100 miles than 50 miles. In years gone by, this was always true: and it still applies to a considerable extent. But it is no longer universally correct. The national railway organisation of the United Kingdom, for example, may agree with a trader to handle all his traffic, from any point to any point on the railway system, on some financial basis which takes no account of the length of haul of a particular parcel on a particular occasion. This, of course, is an innovation which largely makes nonsense of the hinterland theory of port user, and, if ever it became the general rule, the economic stability of many ports would be seriously affected.

(9) **Port charges.** There is little uniformity in the charges levied at ports in exchange for the facilities and services they provide for ships, for goods and for passengers: and it is sufficiently plain that a port could drive traffic away—even traffic belonging to its own hinterland—by fixing its rates at such a level that it would pay traders to send their goods at greater transport cost to a cheaper port. In practice, of course, the governing body of a port, so far as it can and may, provides against any such tendency—both as regards charges against goods and charges against ships.

It will be seen that the nine considerations listed above bear very weightily upon the theory of economic hinterlands as applied to port user and they constantly deflect its application. It is therefore not surprising that in Great Britain, for example, whilst there are over 300 ports, great and small, about 60 per cent. of the overseas trade of the country is conducted on only two rivers—the Thames and the Mersey. However, there remain some notable examples of the influence of ports upon hinterlands, and of hinterlands upon ports The ports of South Wales and of the north-east coast of England owe their importance and their development to the coal shipping trade arising from their adjacent coalfields: and, in turn, these ports have done much for the coal trade. And it should be noted that in port affairs one thing constantly leads to another. For example, the coal owners of Northumberland, Durham and North Yorkshire demanded easy and cheap outlets to the sea and, in consequence, the ports of Blyth, Newcastle, Sunderland, the Hartlepools and Middlesbrough were quickly developed

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from their relatively unimportant original condition. The surrounding population grew and other industries developed—stimulated by the existence of local coal and aided by cheap and convenient port facilities. The growing population created a demand for imported foods and imported housing materials so that the trade of the ports expanded and the ports were able to spend money upon port improvements. Shipbuilding increased in volume and the coming of the railways stimulated every kind of industrial activity. In our day, the development of road transport and the motor engine has led to a great overseas trade in pertoleum products. The latter-day magnification of the iron and steel, chemical and plastic industries has led to the further diversification of trade, the growth of overseas business and the further improvement of port facilities on the north-east coast.

A casual glance at the map of the world will immediately bring home the fact that there is a fairly general connection between great seaports and great centres of population. Exceptions such as Birmingham exist but the broad truth remains. Either the port itself is the home of many thousands (sometimes some millions) of people or they are to be found not far away: and it is not always easy to say whether the population made the port, or the port made the population. In most cases, each stimulated the other.

The great ports flourishing to-day are nearly all old foundations and nearly all river ports. They began, centuries ago, as river-side settlements, in the era when roads were bad or non-existent and, in consequence, water transport was the easiest way of getting about, of transporting food and of getting quickly into or out of a fight. The inhabitants grew up knowing the lore of the river and its ways and they learned to build bigger and better vessels. In time, they ventured further to sea and found the river entrances to other nearby lands. With such countries they learned to exchange settlers, explorers, knowledge and goods. Disputes, pillaging and wars interrupted the progress of trade but it always revived and grew. The fascinating history of ports such as London and Bristol follows exactly on such lines. The River Thames made the port of London, and the port made the city. The Bristol Channel, the River Severn and the River Avon made the port of Bristol and the port made the modern city. The Thames looks out to the Elbe, the Scheldt and the Rhine and thus the trade of London began. The Bristol Channel leads out to Ireland and the Atlantic and across to America and the West Indies with which places the trade of Bristol has ancient and modern associations.

The development of the world's seaports has marched with the development of international trade—and especially with the working out of the " division of labour " among countries. When, by the evolution of the sailing ship, man mastered the ocean distances then the countries of the world began to exchange their produce in increasing volume and variety. The line of development for Britain was determined by her rich coal measures, the seafaring instincts of her island people, the invention of the steam locomotive, the industrial revolution, the invention of the blast furnace, the enterprise of her industrialists, the skill of her workpeople and the political sagacity of her rulers. These things led to a phenomenal growth of her island population so that food to sustain them, besides the raw materials for the many industries, had to be brought from overseas. Thus the traditional and normal seaborne commerce of the United Kingdom consists of the export of coal and manufactured goods and the import of food for the people and primary products for the factories, mills, furnaces and workshops. The economic strains and stresses caused by two world wars in the last half-century, and the political maturing of millions of formerly backward people, have had their modifying effects upon the overseas trade of the United Kingdom, but the broad basis—the exchange of manufactured goods for food and raw materials—still remains.

There is a continuing historic and economic inter-relation between the great navigable rivers of the world, the gradual concentrations of population, the development of water transport, the growth of river-borne and seaborne trade and the founding, expansion and latter-day improvement of the seaports existing at the mouths or upon the estuaries of such rivers, and in some cases, upon the river banks a long way from the sea. The prosperity of nearly every such port has also been greatly influenced by the fertility or the mineral wealth of the country through which the river flows, the industry and skill of the inhabitants and the activities of inland communities led by men with wealth and organising ability.

The rivers, everywhere, are the most ancient routes of inland transport and they have therefore had much to do with the uprise and location of the seaports. The early inadequate roads had little influence upon the matter—but it is a different story when we come to consider the canals, the railways and the modern trunk roads. The canals were cut where a river did not exist or where navigability was poor and they changed the industrial and transport faces of England and Europe in a few short years. They opened up the agricultural and industrial interiors and one of the consequences was the injection of new life into some of the old ports and the foundation of some new canal ports. With the coming of the railways, the inland water route received a setback—in England a very severe one but in Europe less so. But the railways brought their own great addition to the speed, reliability, availability, cheapness and volume of inland transport and they profoundly affected the lives and fortunes of the world's seaports. Some great ports of the past have declined in importance mainly because they were by-passed in the railway building era, or because the new mode of transport left them on branch lines difficult or tedious of access. Conversely, the railways have tapped, with rich results, the vast inland plains and mineral deposits of the world and have carried the yield, or part of it, to the sea—sometimes to an existing port and sometimes to a favourable location where an entirely new ocean terminal has been built. The seaport and railway thus created have served, in the reverse direction, to bring to the new or growing inland communities, from any part of the world, machinery for their work as well as anything else they wanted and could buy.

And, in our own day, we have lived to see the supremacy of the railways severely shaken by the invention of the internal combustion engine and the consequent massive development of road transport. One of its effects on seaports has been to influence their governing bodies to equip or improve their port estates, their quays and their warehouses for the accommodation of road transport vehicles. In the early days of the motor lorry, it was a common complaint that many ports were laid out for railway traffic whilst facilities for road transport were scanty or non-existent. In recent years, there have been great changes: and every modern (or modernised) port now embodies such features as sunken railway lines to give a level surface, lorry loading banks, parking and turning areas, good roads and covered accommodation so that goods may be passed between warehouses and lorries in wet weather. Road signs in and around seaports give clear indications of the routes to the docks: and the main highways of the country include good roads between the centres of industry and the seaports.

In trying to take a broad view of the world's seaports—their distribution, location, characteristics and functions—it is a help to form some general picture of what makes up the global, seaborne carrying trade. Odd, disconnected facts come into such a picture—for example, Britain cannot feed herself, Russia could be entirely self-supporting, Australia is underpopulated, Denmark has no minerals, Britain has no petroleum but uses enormous quantities, Americans like Scotch whisky, Scotsmen prefer Virginia tobacco, the whole world has formed a taste for fruits which are found only in tropical countries, some nations show great mechanical genius whilst others are the world's best farmers, cotton, tea and rice will only grow in hot countries, South Lancashire has a damp climate and soft water, and the petrol engine has replaced the draught horse in nearly every country.

Looking first at the overseas trade of the United Kingdom and taking the published figures for 1948, the total value of the trade was £3,724 millions—imports totalling £2,078 millions, and exports £1,646 millions. In Table 1, which now follows, some details are given of the make-up of the imports total of £2,078 millions. The table gives (1) the separate values of the 22 principal classes of imports and (2) the separate returns of the 24 leading U.K. seaports in terms of the 22 commodities above-mentioned.

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TABLE 1
Imports of the United Kingdom in the year 1948
Expressed in millions of pounds sterling and showing chief U.K. ports of discharge

PRINCIPAL CLASSES OF IMPORTS	LONDON	LIVERPOOL	MANCHESTER	HULL	BRISTOL	GLASGOW	SOUTHAMPTON	NEWCASTLE	BELFAST	LEITH	GRIMSBY	CARDIFF	DOVER	SWANSEA	MIDDLESBROUGH	GRANGEMOUTH	GOOLE	HOLYHEAD	NEWPORT (MON)	ROCHESTER	W. HARTLEPOOL	PRESTON	SUNDERLAND & SEAHAM	METHIL	ALL OTHER U.K. PORTS	TOTAL IN £ MILLIONS
SEEDS & NUTS for OIL, OILS (INCLUDING CRUDE PETROLEUM) FATS, RESINS & GUMS	38	51	9	13	2	3	6	..	..	..	..	..	..	6	..	3	..	..	..	..	..	..	..	..	10	141
MEAT	65	33	2	4	7	4	1	..	..	1	2	2	..	..	..	..	1	3	..	..	..	..	..	..	..	125
PETROLEUM, REFINED	42	7	17	12	14	7	8	4	1	..	3	..	..	2	..	1	..	..	..	..	..	..	..	..	6	124
METAL & METAL MANUFACTURES	37	31	12	5	6	..	3	2	..	..	..	..	..	2	..	..	..	..	3	..	..	..	..	..	6	107
COTTON (RAW & COTTON WASTE)	..	76	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	107
GRAIN & FLOUR (OTHER THAN WHEAT)	26	34	3	11	12	9	..	..	7	..	..	1	..	..	..	..	..	..	..	..	..	..	1	..	..	104
WHEAT	25	20	6	11	15	6	..	4	4	3	1	2	..	..	..	..	..	..	..	..	..	..	..	..	..	97
FRESH FRUIT & VEGETABLES	26	16	1	6	3	3	11	2	1	1	..	1	7	..	..	..	..	..	..	..	..	..	..	..	15	93
WOOD & TIMBER	25	16	6	8	..	3	2	3	2	2	3	4	..	..	..	2	..	..	1	..	4	..	..	..	12	93
WOOL	28	39	2	12	..	..	4	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	1	87
MISC. FOODSTUFFS (NOT INCLUDED ELSEWHERE)	24	19	1	3	2	3	3	2	..	..	3	..	2	..	..	..	..	..	..	..	..	..	..	..	8	70
MANUFACTURES OF TEXTILE MATERIALS	15	16	7	2	..	17	..	..	5	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	5	69
BUTTER	31	10	..	8	4	..	..	4	..	3	3	2	..	..	..	..	1	..	..	..	..	..	..	..	2	68
DAIRY PRODUCE OTHER THAN BUTTER	25	16	2	5	2	..	..	2	..	1	1	..	1	..	..	..	..	1	..	..	..	..	..	..	7	63
ORES, CONCENTRATES & SCRAP	5	21	..	..	2	3	..	2	..	..	1	2	..	3	9	1	..	..	2	..	..	..	1	..	9	61
SUGAR, UNREFINED	27	20	..	1	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	9	59
BEVERAGES OTHER THAN TEA	24	8	5	5	6	2	1	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	4	56
TEA	35	14	3	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	55
PAPER MAKING MATERIALS	15	3	8	2	3	..	..	..	..	2	1	..	..	..	..	2	1	..	..	6	..	3	..	1	5	52
MACHINERY	13	13	5	1	1	2	4	..	..	..	..	..	1	..	..	..	1	..	1	..	..	..	..	..	2	44
TOBACCO, UNMANUFACTURED	10	15	2	..	9	2	1	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	42
RUBBER	13	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	29
ALL OTHER IMPORTS	124	53	18	18	12	7	9	4	3	9	1	4	3	3	3	3	5	6	1	1	1	1	1	..	42	332
TOTALS IN £ MILLIONS	673	546	139	127	100	73	53	29	26	22	21	18	17	16	12	12	10	10	8	7	5	4	3	1	146	2078

In Table 2, set out below, is shown the make-up of the exports total of £1,646 millions. The table gives (1) the separate values of the 14 principal classes of exports and (2) the separate returns of the 24 leading U.K. seaports in terms of the 14 commodities above-mentioned.

TABLE 2
Exports of the United Kingdom in the year 1948
Expressed in millions of pounds sterling and showing chief U.K. ports of shipment.

PRINCIPAL CLASSES OF EXPORTS	LONDON	LIVERPOOL	MANCHESTER	HULL	BRISTOL	GLASGOW	SOUTHAMPTON	NEWCASTLE	BELFAST	GRIMSBY	CARDIFF	DOVER	SWANSEA	MIDDLESBROUGH	GRANGEMOUTH	GOOLE	HOLYHEAD	NEWPORT	W. HARTLEPOOL	PRESTON	SUNDERLAND & SEAHAM	METHIL	BLYTH	HARWICH	ALL OTHER U.K. PORTS	TOTAL IN £ MILLIONS
MACHINERY	84	93	12	10	..	18	5	4	1	1	1	1	3	4	1	4	2	1	..	..	..	..	..	2	6	253
VEHICLES (INCLUDING NEW SHIPS)	90	65	6	5	3	12	8	7	2	..	1	2	..	4	1	1	1	2	3	1	7	..	1	1	20	243
METALS & METAL MANUFACTURES	36	47	..	10	..	11	2	2	..	1	1	..	7	7	2	3	1	9	..	..	..	..	..	1	28	168
MISC. MANUFACTURES (NOT OTHERWISE MENTIONED)	59	49	4	7	1	14	5	1	2	..	..	1	1	..	1	..	1	1	..	..	..	..	..	1	5	153
COTTON GOODS	11	86	11	4	..	7	5	..	..	..	..	..	..	..	..	1	1	..	..	..	..	..	..	..	2	128
WOOLLEN GOODS	15	40	9	7	..	4	8	..	..	..	..	1	..	..	..	5	4	..	..	..	..	..	..	..	3	96
FOOD, DRINK & TOBACCO	43	19	2	2	..	..	2	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	25	94
CHEMICALS, DRUGS, DYES & COLOURS	27	32	4	3	..	2	1	..	..	2	1	..	..	4	..	..	..	1	..	..	..	..	..	..	6	83
ELECTRICAL GOODS & APPARATUS	40	21	2	1	..	1	2	..	..	..	..	..	1	..	..	..	1	1	..	..	..	..	..	1	1	72
POTTERY, GLASS, ABRASIVES (INCLUDING CEMENT ETC)	13	20	3	1	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	45
CUTLERY, HARDWARE ETC	18	13	1	1	..	1	2	..	..	..	..	..	..	..	..	1	1	..	..	..	..	..	..	1	4	43
COAL	..	2	..	5	..	1	..	4	..	5	5	..	3	..	..	1	..	3	1	..	2	3	3	..	1	39
SILK GOODS	9	21	2	1	..	1	3	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	1	39
APPAREL	11	7	1	1	..	1	5	..	..	..	..	1	..	..	..	..	2	..	..	..	..	..	..	..	2	31
ALL OTHER EXPORTS	27	18	12	7	4	15	8	8	2	1	1	7	1	2	2	2	3	2	..	2	1	..	..	3	31	159
TOTALS IN £ MILLIONS	483	533	69	65	8	89	57	26	7	11	10	13	16	21	7	18	18	20	4	3	10	3	4	10	141	1,646

It may be useful for the reader to have before him the total trade figures for the two following years, and these are included below:—

	1948 Millions £	1949 Millions £	1950 Millions £
Imports	2,078	2,274	2,603
Exports	1,646	1,844	2,255
Difference	432	430	348

It should be borne in mind that the *volume* of trade does not necessarily change with total *value*. For example, there was virtually no change in the volume of goods imported in 1950 as compared with 1949: but the volume of exports increased by about 16 per cent. (Annual Report of Chamber of Shipping, 1950/51.)

Table 3 reproduced in the accompanying inset carries the analysis of the 1948 import a little further by showing the countries of origin, with the value from each, and the principal overseas ports of shipment. The U.K. ports of discharge are repeated, for easy reference, alongside each of the commodities.

Further information is given in Table 4 (also shown in the inset) relating to the 1948 export total of £1,646 millions. The destination countries are given for each commodity, with the value of the quantity shipped and the principal overseas ports of discharge. For immediate reference, the chief U.K. ports of shipment are repeated against each commodity.

The trades discussed in the preceding pages are those in which the United Kingdom plays a part, either as an importing or an exporting country. It will be helpful now to try to envisage the commerce of the United Kingdom against the background of world trade as a whole. From information published by the Statistical Office of the United Nations it may be deduced that during the year 1949 something like 412,000,000 net register tons of shipping cleared from the world's seaports in external trade. The volume which cleared from United Kingdom ports was of the order of 41,000,000 tons—leaving a balance of 371,000,000 which cleared from ports outside the United Kingdom. In that same year, 1949, the volume of shipping from foreign ports which entered U.K. ports was about 55,000,000 tons, so that there must have been about 316,000,000 tons of shipping which sailed away from ports outside the United Kingdom and made voyages to ports also outside the United Kingdom. To this figure of arrivals at other ports must be added the 41,000,000 tons which left U.K. ports for foreign—making total arrivals at non-U.K. ports about 357,000,000 tons. In rough percentages, the United Kingdom, as a receiving country, berthed about 12½ per cent. of the world's seaborne traffic: and, as a despatching country, sent out about 10 per cent. of the global total.

In the matter of the share of global shipping handled in that year, the United Kingdom was the second greatest force in the world: the greatest of all was the United States of America, where berthage was given to over 13 per cent. of world shipping and whence 15 per cent. of outgoing world tonnage was despatched.

The third position in the world list was occupied by Canada. France came next, followed by Brazil, Belgium, Italy, the Netherlands, Sweden, Spain and Malaya. Other countries with important positions as shipping termini were Australia, Ceylon, Denmark, Hong Kong, India, Ireland, Norway, Pakistan, the Philippines, Poland, Portugal and South Africa.

The table upon which the foregoing remarks are based is given below and it will be seen that it is not complete or uniform in all respects. For most of the countries listed, figures are available for both entrances and clearances—but in a few cases, only one or other of the figures is recorded. Again, whilst for the most

Port Economics—continued

important countries, the figures represent vessels with cargo only —for some of the smaller countries, the figures include vessels with cargo and in ballast. Lastly, in a very few cases, coastwise figures are included. The general conclusions stated above have therefore been reached by using some approximations, and, in consequence, although they present a useful overall picture, they are not absolutely accurate.

International Sea-borne Shipping in the year 1949

(Based on the monthly Bulletin of Statistics issued by the Statistical Office of the United Nations, with some approximations)

TABLE 5

Country	Thousands of N.R.T. Entered	Cleared	Country	Thousands of N.R.T. Entered	Cleared
			Brought forward	135,900	168,528
Australia	6,216	5,808	Malaya	14,340	12,996
Belgium	18,840	19,416	Mexico	1,128	2,256
Brazil		22,392	Netherlands ...	18,828	15,672
Burma	1,188	1,548	New Zealand ...	2,184	1,704
Canada		44,280	Norway	4,488	3,576
Ceylon	7,680	6,840	Pakistan	3,660	2,568
Chile		2,916	Peru		9,612
Denmark	8 100		Philippines ...	5,712	5,700
Dominican Republic		2,256	Poland	8,016	
Finland	2,484	3,324	Portugal	4,944	
France	35,820	28,332	Spain	13,656	
Greece	4,596		Surinam	1,668	
Hong Kong ...	11,856		Sweden	16,416	16,140
India	8,892	6,708	Thailand	1,080	1,464
Indo China ...		1,812	Tunisia	3,492	
Ireland	6,480	4,404	Union of South Africa ...	8,088	7,704
Israel	2,052		United Kingdom	54,900	41,520
Italy	19,368	18,492	United States of America ...	59,208	61,788
Lebanon	2,328				
Carried forward	135,900	168,528	Totals	357,708	351,228

	Net Register Tons
Total entrances from above-given figures	357,708,000
Add clearance figures for countries where no entrance figure is given	83,268,000
Approximate total entrances	440,976,000
Total clearances from above-given figures	351,228,000
Add entrance figures for countries where no clearance figure is given	60,708,000
Approximate total clearances	411,936,000

In Table 6 (also shown in the inset), an attempt has been made to give, in one statement, a general picture of world seaborne trade in the year 1948. This table may be useful to those who are unfamiliar with the principal port traffics, their countries of origin and the countries which import them. The table may be used, reading vertically, to study the overseas trade of a particular country; or, by reading across, an idea may be gained of the world interchange of any particular commodity.

Imports are indicated by a solid black square, exports by a black disc. Where a country has a two-way trade in a particular commodity and the imports predominate, the symbol used is a white figure with a central black dot: where the exports predominate, the symbol is a white disc.

A two-way trade may arise either because the country is a re-exporter of imported merchandise or simply because the country imports one sub-division of a particular class of goods and exports another sub-division of the same general class. It is not claimed that Table 6 covers anything like the whole scope of world trade in 1948, but it will take the student some way in the matter. In particular, it must be remembered that the table deals only with seaborne trade and therefore traffic across land frontiers is not shown. It should be mentioned, also, that only considerable volumes of trade are noticed and therefore a quantity of world seaborne business, great in the mass but highly diversified in character and direction, escapes inclusion.

World Tonnage.

Armed with some idea of the principal port traffics, the countries which exchange them, and the chief seaports concerned in the business, the student will do well now to learn something about the ships which do the carrying. The following estimated figures, taken from the 1950/1951 Annual Report of the Chamber of Shipping of the United Kingdom, will help to give a general idea of world merchant shipping as at the 31st December, 1950 :—

World total —15,378 vessels aggregating 77,405,000 gross tons (including U.S.A. reserve fleet, laid up, of 14,000,000 gross tons).

The four leading owning nations were :

United States of America —3,516 vessels aggregating 26,114,000 gross tons (including reserve fleet above-mentioned).
United Kingdom—3,002 vessels aggregating 16,557,000 gross tons.
Norway —1,089 vessels aggregating 5,223,000 gross tons.
Panama —545 vessels aggregating 3,350,000 gross tons.

The following countries had more ships but less total tonnage than Panama :—

France, 573 vessels; Holland, 585 vessels; and Sweden 664 vessels.

In all the above-given figures, vessels under 500 gross tons are ignored: and, in the particular case of the United States, vessels under 1,000 gross tons are ignored.

As at the 30th June, 1950, the total number of foreign-going vessels owned and registered in the United Kingdom was 2,122 aggregating 14,647,000 gross tons. This total was made up as follows:—

	(1) Number of Vessels	(1) Gross register tons
Passenger-cargo liners ...	258	3,147,000
Cargo liners	855	5,219,000
Tramps	587	3,136,000
Tankers	422	3,145,000
	2,122	14,647,000

(1) Trading vessels of 100 gross tons and over.

It is not possible, within the compass of the present study, to attempt to deal in greater detail with the world merchant fleet: but the student will find it profitable to familiarise himself with the names and berth ports of the great liner companies and with the trans-ocean services which they maintain: and also to learn something of the activities of the tramp-owning firms and the oil-tanker groups. Much of this information may be found in the "Directory of Shipowners, Shipbuilders and Marine Engineers, 1951, compiled under the direction of the editor of "Shipbuilding and Shipping Record" and published by the Tothill Press, Ltd., London. A special note should be made of the number of large and extra-large ships included in the various fleets because the great size of some modern ships is a problem of special concern to port economists.

Meeting to Discuss Cargo Handling.

At the meeting of the executive committee of the International Cargo Handling Co-ordination Association, held at Antwerp on 28th ult., it was decided that the full technical meeting of the Association should be held at Rotterdam on April 21st, 22nd and 23rd next. A number of papers will be read and discussed at the meeting, and visits will be arranged to the ports of Amsterdam and Rotterdam. Further information may be obtained from the offices of the Association, 39, Wilton Road, London.

German Decca Navigator Chain Opened.

The German chain of Decca Navigator transmitting stations was opened last month by Dr. Seebohm, West German Minister of Transport, at a ceremony at Dusseldorf airport. This is the fourth Decca Navigator Chain to be completed and forms the important link between the British Chains and the Danish Chain. The German transmissions, together with those of the French stations, due to be completed later this year, will provide navigational coverage in Europe extending from the Bay of Biscay to the Baltic and from the Alps to the limits of the North Sea. Though primarily an air navigational Chain, this extension of the Decca Navigator system also affords high-accuracy cover for shipping operating in the North German coast area. It is reported that great interest is being shown in German shipping circles, and their ships are being fitted with the Decca Navigator in considerable numbers. The air coverage of the new Chain includes all Western Germany, Berlin and its approaches, Holland and Belgium.

Navigation Lights for the Port of Leith

Description of Recent Marine Lighting Installation

By K. C. SUTTON-JONES

The Port of Leith, situated on the South shore of the Firth of Forth, put into operation in November last, a new system of navigation lights with port and tidal signals. This new scheme, necessitated by the completion of two new breakwaters, is probably the most modern in Great Britain, if not in the world, and contains many items of technical interest.

Until the new breakwaters were constructed, the dredged channel leading to the Docks at Leith was protected by two Piers, the seaward extremities of which were indicated by lighthouses exhibiting white and green lights respectively. In addition, variation in tide level was signalled from the West Pier by daymarks and lights hoisted manually, and a reed type fog signal was also installed on this Pier.

The new breakwaters are to seaward, and enclose a large tidal bay to the West, where extensive new berthing facilities are projected. New deep-water quays have, in fact, been constructed already, but a description of these does not come within the purview of this article.

The new East and West breakwaters are some 2,800 feet and 3,700 feet in length respectively, and protect a dredged entrance channel 400 feet in width, there being a distance of 800 feet between the heads of the breakwaters.

The Tide Signals are exhibited from the head of West Breakwater which is also the site of the principal port-locating lighthouse and control point for nearly all the approach lighting and signalling facilities.

The complete system of harbour-approaching facilities comprises the following:

Port-Locating Facilities.

(a) **Clear Atmosphere:** Port-locating lighthouse situated on West Breakwater Head, East Breakwater Head Lighthouse.

(b) **Misty or Foggy Atmosphere:** Diaphone fog signal installation on West Breakwater Head.

Port-Approaching Facilities.

Tide-level indication by day and night—installed on West Breakwater Head. These also include approaching storm and port closed signals.

Leading lights for alignment of approach to the dredged channel—situated behind the root of the East Breakwater.

Other Facilities.

Speed indicating lights are spaced along the East Breakwater at half cables distances and these provide an estimate of a vessel's progress once inside the harbour area.

The character of the existing lighthouse at the entrance to the fishing harbour of Newhaven has been changed to a white flashing from a fixed white light. This lighthouse is situated near the root of the West Breakwater.

The above are shown on Fig. 1.

East and West Breakwater Lighthouses.

The presence of strong background lighting was the chief problem to overcome in establishing a conspicuous light which, at the same time, had to produce the minimum of glare to the approaching navigator. This was made more difficult in the case of West Breakwater by the allocation by the Lighthouse Authority of an occulting rather than a flashing character. The East Breakwater exhibits a quick single flashing character and in this way the two Breakwater head lights clearly define the channel entrance.

The optical apparatus in the lighthouses are similar, each consisting of a dioptric ground and polished glass lens subtending 270° horizontally—at the focus of which is fitted a filament lamp (a 500-watt lamp in a 500 mm. diameter lens is employed at West Breakwater, a 100-watt lamp is installed in a 375 mm. diameter lens at East Breakwater). The lamp in each case is "flashed" (or "occulted") to provide the the character of the light-station and, together with a standby lamp, is mounted upon an automatic lampchanger. Cessation of current during the "flash" period in the circuit connecting the lamp in focus (i.e. when the lamp is burned out) sets a trip-mechanism into operation whereby the standby lamp is brought into focus and kindled automatically. An alarm lamp situated on the main control panel on West Breakwater and conspicuously on the side of the tower at East Breakwater, is illuminated when the standby lamp is in focus, and cannot be extinguished until a new lamp has been installed and the lampchanger reset (see Fig. 2).

Prefocus lamps and lampholders are employed throughout the harbour lighting scheme by which means the focal accuracy within the lens is assured without adjustment.

The lens and lampchanger at each lighthouse are mounted upon a cast iron table and column and installed within a circular lantern of 7-ft. 1-in. diameter of glazing. The lanterns have inclined glazing bars to prevent complete obscuration of the light in any direction and have cast iron murettes (or lower portions) and conical roofs of copper sheet.

Electrical power is obtained from the local L.T. network and stepped up to 3.3 K.V. for transmission along West Breakwater to the control point at the Breakwater head. This supply is connected to East Breakwater lighthouse from West Breakwater by

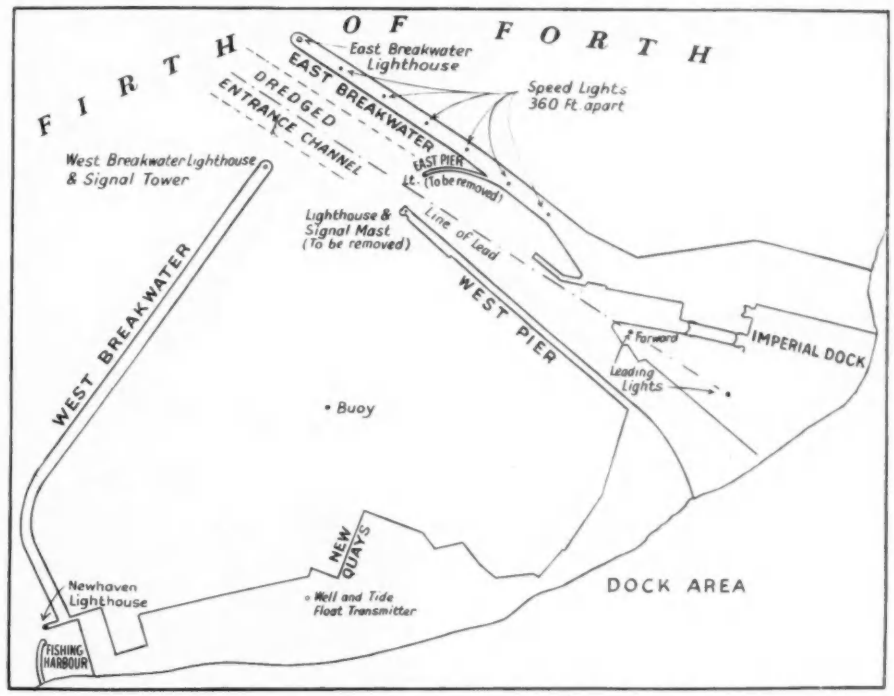

Fig. 1. Plan showing new breakwaters and position of navigation lights at Port of Leith.

Navigation Lights for the Port of Leith—continued

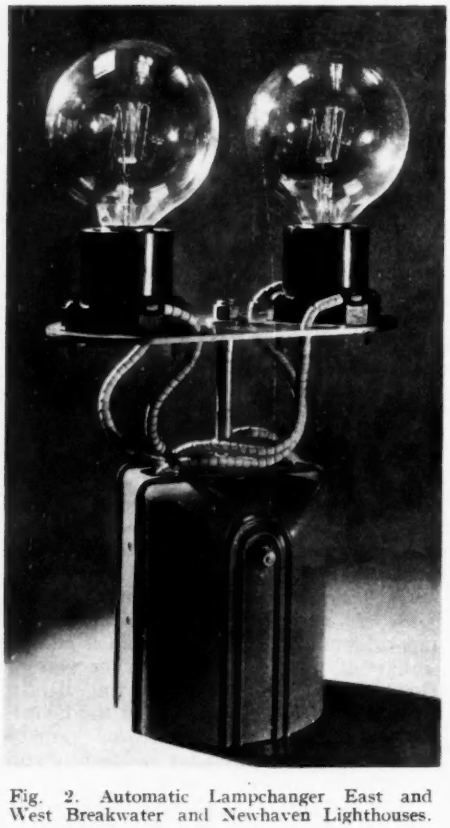

Fig. 2. Automatic Lampchanger East and West Breakwater and Newhaven Lighthouses.

a submarine cable. Failure of the mains supply causes the standby automatic power unit at West Breakwater to supply all services within about 10 seconds (see later). In the event of the submarine cable being cut, thus isolating the West Breakwater lighthouse, an alternative supply along the East Breakwater can be employed.

The Lighthouse Towers are octagonal in plan and the East Breakwater Tower contains the switchgear and associated motor-driven character cam mechanism for flashing the light-source. A similar mechanism fulfils the same function at West Breakwater but is located in the main control cubicle.

The West Breakwater Lighthouse exhibits light for 8 seconds followed by a 2-second eclipse. The East Breakwater Lighthouse exhibits a flash of 0.2 second followed by a 1.3 second eclipse. The apparent beam intensities at these characters are 13,400 and 930 candelas, respectively.

A diaphone fog signal (type "C") is installed below the lantern at West Breakwater. This operates by compressed air and comprises a gun-metal piston and cylinder each cut with circumferential slits. The piston reciprocates and causes the emitted air to be cut 180 times per second. The air supply is provided by one of two electric motor-driven compressor plants operating off either the mains electric or standby electric supplies. The character (single blast of 2 seconds' duration every 15 seconds) is arranged from electrically-controlled valves. This electrical circuit is "coded" by an additional cam on the West Breakwater light character motor referred to above.

Port-Approaching Facilities.

The state of the tide within the dock area has to be clearly indicated to all vessels approaching the port both by day and night. This had been achieved previously at West pier by the manual-hoisting of daymarks and lights. This system has been replaced by the exhibition of daymarks and lights permanently mounted on a tower situated at the seaward end of the West Breakwater. The arrangement adopted is similar to that installed at the entrance to the North Sea Canal at Imuijden, Holland, although the method of control at Leith is of special interest.

The Tide Signal Tower is of openwork galvanised steel, 54-ft. in height, of 40-ft. breadth and 10-ft. in width; thus offering a square shape facing seaward. The daymark indicators consist of steel plates, pivoted horizontally at the point of balance which are capable of being tilted vertically to "show" and horizontally to "obscure." Two vertical lines each of five daymarks indicate the state of tide. When approaching from seaward, the left hand line comprises five rectangular plates. These indicate five-foot levels as follows: 10, 15, 20, 25 and 30 feet. The right hand line comprises four triangular plates indicating one-foot levels and one diamond-shaped plate indicating the six-inch level. For example: the exhibition of four rectangular plates, three triangular plates and the diamond plate indicates a level of 28-ft. 6-in.

A fixed light is mounted beside each daymark red for 5-ft., green for 1-ft. and amber for 6-in. indicators) and these provide indication at night.

In addition to the tide-level indicators, a circular daymark plate surmounts the tower and underneath is a group of four fixed red lights. These indicate that the port is closed by day and night respectively. A further red flashing light is provided for signalling the approach of a storm—the day signal is in the form of the customary hoisted storm cone.

Each daymark is mounted on a shaft which rotates in totally-enclosed weather-proof bearings — the latter being supported upon columns. The red, green and amber light lanterns are mounted upon separate columns and both lights and daymarks are arranged on five separate galleries on the tower—access being provided by a ladder at one end.

The complete arrangement is illustrated in Fig. 3.

The lanterns are of the holophotal type, each comprising a 48-watt, 24-volt prefocus lamp, 4-in. focus moulded glass lens spreading the beam over 30° horizontally, and a spherical reinforcing mirror and colour filter. An identical standby lamp is fitted, with the main lamp, on an automatic lampchanger. By this means a standby lamp is brought into focus and illuminated upon failure of the main lamp. The lantern is weatherproof, access being provided via the hinged roof (see Fig. 4). The light-power derived from each lantern is 300 candelas red light, 300 candelas green light and 750 candelas amber light.

The approaching storm light is "flashed" by a small synchronous motor-driven cam mechanism located in the control unit within the buildings on West Breakwater head.

Fig. 3. West Breakwater Lighthouse and Tide-Signal Station.

Navigation Lights for the Port of Leith—continued

The tidal level is determined accurately from a distant well located within the new harbour area. At this point, the level is not influenced by wave motion and, to provide a further safeguard, the water is syphoned into the detecting float chamber—the syphoning equipment being duplicated. The movement of the float is transmitted electrically on the Elliott-Shotter principle to an indicator and recorder situated in the control room at West Breakwater head. These are calibrated according to the level over the sill at the entrance to the Imperial Dock within the harbour area.

As the float reaches new levels (one-foot intervals up to half tide and six-inch intervals thereafter) an alarm bell is made to ring. This bell is rung by the unbalancing of a circuit—the balancing of which can be achieved only by the exhibition of the correct daymarks and lights. Thus the bell continues to ring until the correct arrangement of signals is exhibited on the tower.

The exhibition of the daymarks and lights is controlled manually from the control room—by the lightkeeper, and the satisfactory operating of the signal is detected through contacts actuated by the daymarks on the tower. Both day and night signals are given unless the " night overriding switch " is " off " so that, in the half-light of dusk and daybreak, both daymarks and lights are exhibited.

The normal operation of daymarks and lights is indicated by separate small lamps arranged in a group on the control panel. A separate group of lamps is provided, any of which are illuminated in the event of a lampchanger operating in a tide signal lantern. Thus, lamp failure in the lanterns is indicated on the control panel. Similar groups of lamps are provided for the " port closed " and " approaching storm " signals.

The buildings on the West Breakwater head are illustrated in Fig. 3.

A 24-hour watch is maintained from the watch room located immediately below the lighthouse tower. This room has windows which provide a complete surveillance of the harbour entrance and approaches and directions to shipping may be given from here through loud-hailing apparatus. The control panel with afore-mentioned indicators, the tide signal indicators and recorder and the tide signal controls are all mounted along the same wall in this room.

The control cubicle and panel have been designed to provide the most serviceable arrangement for the keepers. The control cubicle contains all the switchgear, character motors, contactors etc. associated with the distribution of current from the mains and standby power supplies to the lighthouses at Newhaven and on East and West Breakwaters and to the signal tower.

The voltage of the 3-phase mains supply is stepped-up to 3.3 K.V. for transmission to the end of West Breakwater where it is transformed down to 230-volts, phase neutral. In the event of this supply failing or fluctuating seriously, a 35 h.p., 4-cylinder diesel engine-driven alternator set commences duty and supplies the load within about 10 seconds of mains failure. The plant together with the duplicate motor-driven compressor plants and main air storage tank for the diaphone fog signal are housed within a room situated behind the control room.

Fig. 4. Holophotal Lantern used on Tide-Signal Tower and Leading Lights.

Power for cranking the diesel engine is derived from a starter battery and starter motor which latter also has shunt windings from which the battery is recharged after the plant has started. The power plant will not shut down after mains supply restoration until the starter battery has become recharged. The plant will shut itself down automatically and an alarm bell will ring in the event of over-loading, failure of lubricating oil pressure in the engine, excessive radiator temperature or fluctuation in speed. The source of failure is shown automatically on a flag indicator to facilitate rectification. The alarm and control circuits are supplied from a starter battery and all switchgear associated with the plant is housed in a cubicle located also in the power room.

The leading lights are situated near the root of East Breakwater some 800-ft. apart. The lanterns are very similar to those mounted upon the tide signal tower. Fixed red lights are exhibited from the tops of galvanised openwork steel towers—the forward focal plane being 22-ft. and the rear focal plane being 34-ft. above H.W.O.S.T. These lights operate from a converted D.C. supply and have a 75 hours' standby supply provided by a battery which is connected automatically upon mains supply failure. The angles subtended by the lights are narrow and the minimum light power in the beam is approximately 300 candelas.

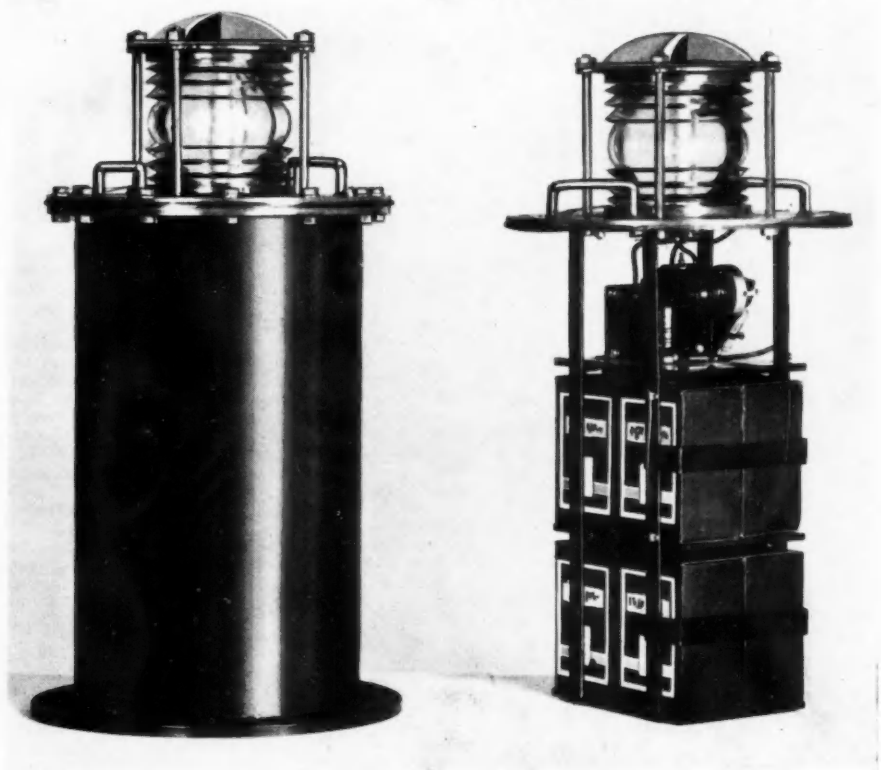

Fig. 5. Single Flashing Apparatus for Buoy.

Navigation Lights—continued

The Newhaven lighthouse is now modernised and supplied with current from West Breakwater. The existing optic has been equipped with a 250-watt prefocus lamp, standby lamp and automatic lampchanger very similar to those already described for East and West Breakwater lighthouses. In the event of lamp failure, an indicator lamp situated on the side of the tower facing West Breakwater is illuminated and cannot be extinguished until the faulty lamp is replaced. A character motor is installed for imparting a single white flash of 2 seconds' duration every 6 seconds.

A small automatic battery-operated light has been supplied for installation on a buoy marking the dredged limits of an approach channel. This apparatus provides a single quick flashing red light and remains unattended for about 6 months from a dry battery supply. This unit has been supplied by Messrs. Chance-Londex (see Fig. 5).

All the light power figures given above have been computed in accordance with British Standard Specification 942/1949.

The lighthouse and ancillary works were designed and their construction supervised by the Engineering Staff of the Leith Dock Commission under the supervision of Mr. M. C. White, B.Sc., A.M.I.C.E., M.I.E.S. The optical, electrical and structural equipment for the various lights, tide and fog signals was designed, supplied and installed by Messrs. Chance Brothers Ltd., Lighthouse Engineers, Smethwick, Birmingham. The Tide Signal and Recorder Apparatus was designed by Messrs. Elliott Brothers (London) Ltd., in co-operation with Chance Brothers Ltd., and the Cables and Transformers were supplied and installed by Messrs. Johnson Phillips Ltd.

Correspondence

To the Editor of *The Dock and Harbour Authority*.

Dear Sir,

Port Economics

I have been much interested in the introduction to the series of articles on Port Economics by Mr. A. H. J. Bown. I am provoked to ask if you would grant space for this letter since I feel that this series, as I understand the form the contributions are likely to take, justifies my referring to work being done on ports in other spheres.

I am writing to you as a geographer, one of many interested in geographical studies of ports throughout the world. At a meeting of the International Geographical Union in Amsterdam in 1938 it was decided to establish a Commission on Industrial Ports. The Commission came into being shortly after the end of the war and has as members Professor Boerman of Rotterdam (Chairman), Professor Somme of Bergen, Professor Delmer of Liege, Professor O'Dell of Aberdeen and myself as Convenor. There have been several meetings of the Commission and it may interest your readers if I mention very briefly some of the matters of particular interest to the members, especially in view of the several and significant questions put forward by Mr. Bown.

Discussions at meetings of the Commission have tended to focus upon the following items—the definition of the hinterland of a port: the effect of the industries within the port upon the extent of the hinterland: factors contributing to the location and development of industries within a port: port statistics—and the problems of interpretation produced by their extremely varied character: bibliographies of port literature. In discussion and in papers read, many of the questions raised by Mr. Bown have been involved and I am sure my colleagues would agree that very many of them fall within our geographical approach to port study. However, what I really want to stress is that we have found that there is necessity within our own field of work to concentrate upon certain aspects of port studies and in a preliminary report of the Commission (to be published shortly) there are suggestions that special attention should be paid to the problem of defining port hinterlands; the nature and effect of industries within a port; the co-ordination of port statistics and methods of compiling bibliographies of recent port literature.

It is expected that these items will be the subject of discussions to be arranged in Washington in August of this year—Washington being the location of the next Congress of the International Geographical Union. Before that date the Preliminary Report of the Commission will have been published. It is also hoped that corresponding members of the Commission will be able to report on port developments in their respective territories. I should explain that we have divided up the world into a series of port regions, with a corresponding member for each (although there are one or two gaps yet to be filled). This is intended to give us a working base for future studies and ensure that information is made available readily.

I put these matters forward since it seems appropriate to do so at this stage, when, amongst others, economic geographers are looking forward to Mr. Bown's further contributions in your columns.

(Signed) G. H. J. DAYSH
B.Litt. (Oxon).

Dept. of Geography,
King's College,
University of Durham.
18th January, 1952.

Wanted :

B. **self-loading HOPPER**

of 1000 c.y. or larger.

Write Box 132 "Dock & Harbour Authority,"
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Imperative that applicants have had previous experience in charge of similar installation and be familiar with the handling of all types of liquid cargoes. A full knowledge of Customs requirements and formalities essential. Applicants must be able to supervise staff. A pension scheme is in operation. Salary according to qualifications and experience.

Applicants should write fully, stating qualifications, age and experience to Box 5567, c/o Charles Barker & Sons Ltd., 31, Budge Row, London, E.C.4.

TENDERS

SALE BY TENDER.

HARBOUR SERVICE CRAFT.

Following the completion of works on the reconstruction and extension of a deep water outfall sewer at Folkestone, the Corporation now invite tenders for the purchase of the Craft and Equipment which they bought during the course of this work over the past two years. The principal items contained in the inventory of this plant are as follows:—

SELF-PROPELLING BARGE "CAMIMAC," converted landing craft built by Towler & Sons in 1945. Steel hull, length 57½-ft., beam 17-ft., loaded draught 5-ft. Driven by two "Hudson Invader" 168 petrol engines each 60 H.P., speed 12 knots max. Covered wheelhouse. Fitted with overhead steel gantry carrying A.C.E. hoist powered by 10 H.P. Lister petrol engine for lift of 2½ tons. Equipment includes a 220 volt generator driven by a Crompton Parkinson 1½ H.P. petrol engine for deck lighting, four horizontal deck capstans and two winches fore and aft, anchors and mooring wires, navigation lights, safety appliances and raft for 14 persons. Lying at Dover Harbour. Photograph on application.

TWO HARBOUR SERVICE LAUNCHES, "STUART" and "MALCOLM," ex-Admiralty. Clinker built. Dimensions: length 36-ft., beam 8-ft., draught 3-ft. Driven by Ford V.8, Vosper conversion engine 65 H.P. in casing aft, speed 10-12 knots. Complete with 12-volt battery, anchor and mooring cable, navigation lights and safety appliances. Lying at Folkestone Harbour.

HARBOUR SERVICE LAUNCH, "ILLYNA," ex-R.A.F. marine tender. Dimensions: length 24-ft., beam 7-ft., draught 3¼-ft. Forward cockpit and after saloon. Driven by Perkins 6 M. diesel engine, 60 H.P., speed 15 knots. Complete with two 6-volt batteries, anchor and mooring cable, navigation lights and safety appliances. Lying at Folkestone Harbour.

CLINKER BUILT ROWING BOAT, "JANET," 12-ft. long by 6-ft. beam, with oars. Fitted with "British Seagull" clutch model outboard petrol engine, 1½ H.P. Lying at Folkestone Harbour.

(continued at top of next page)

All these craft are maintained in good working order and in a seaworthy condition.

A copy of the complete inventory may be seen at the offices of the Town Clerk and permission to view the Craft may be obtained on application to him.

Tenders shall be enclosed in a sealed envelope marked "Plant Tenders" and addressed to the Town Clerk, Folkestone, so as to reach him by the first post on Saturday, 1st March, 1952.

The Corporation do not bind themselves to accept the highest or any tender.

Town Clerk's Office,
West Terrace,
FOLKESTONE, Kent.

(Signed) C. F. NICHOLSON,
Town Clerk.

DUBLIN PORT AND DOCKS BOARD.

Tenders for Installation of Oil Pipelines at Port of Dublin.

The Dublin Port and Docks Board is prepared to consider tenders for the installation of an oil pipeline system at the Port of Dublin.

The work to be done involves the erection, on previously prepared supports, of the following approximate lengths of piping:—

20,000 feet 10-inch nominal bore
6,000 feet 8-inch nominal bore
2,500 feet 6-inch nominal bore
1,000 feet 4-inch nominal bore
8,000 feet 3-inch nominal bore

and also the installation, in the various pipe runs, of a number of Steel Gate Valves and Check Valves, Steel Flanges and both Long and Short Radius Bends.

Valves, Flanges and Bends will be supplied by the Board. Pipes may also be supplied.

Pipes will be welded throughout and the Flanges welded to them at valve positions, etc.

The following alternative tenders will be considered:—

(a) For fabrication and installation only, all pipes, flanges, valves and specials being supplied by the Board.
(b) Fabrication and installation with pipes supplied by the Contractor and the flanges, valves and specials supplied by the Board.

Specification, Conditions of Contract and Drawings may be obtained on application to the Engineer's Office, Dublin Port and Docks Board, East Wall Road, Dublin.

Each application must be accompanied by a deposit of £5 0s. 0d. (Five Pounds) returnable on receipt of a bona-fide tender.

Port and Docks Board,
Dublin.
25th January, 1952.

By Order,
R. F. LOWE,
Secretary.

PYE

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Export enquiries to:— Pye Ltd., Radio Works, Cambridge.

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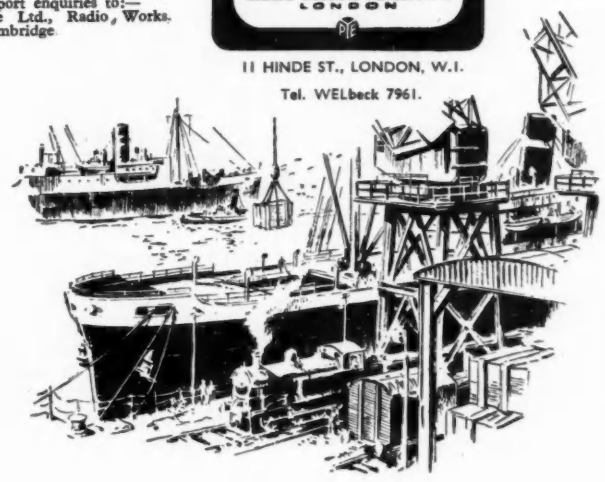
Tel. WELbeck 7961.



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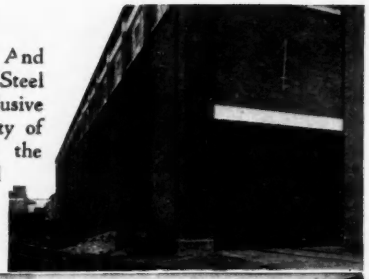

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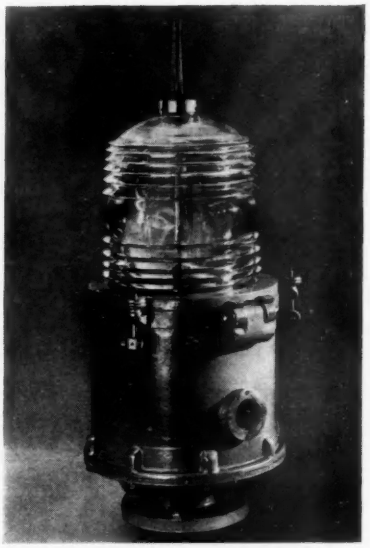

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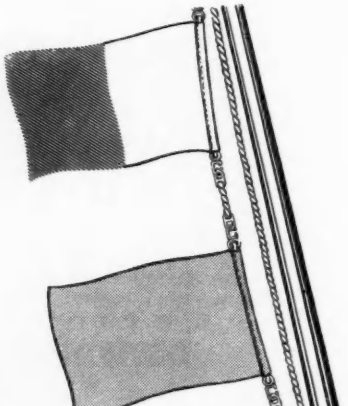

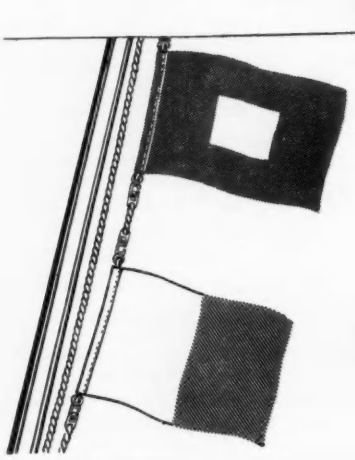

The Port of **Bristol**

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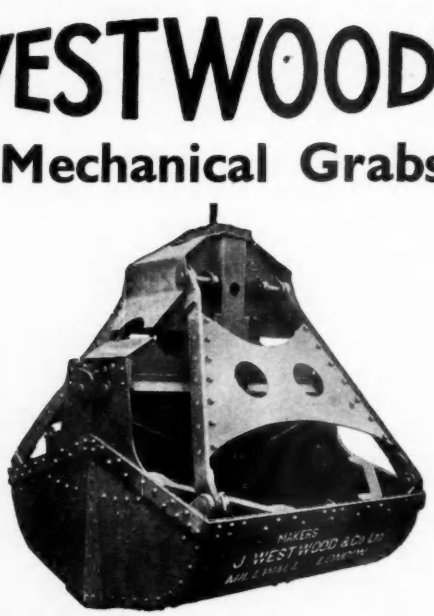

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